



Analysis of US Patent Referencing to IEEE Papers, Conferences, and Standards 1999-2019

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Executive Summary

IEEE engaged 1790 Analytics in this project to assess the impact of IEEE publications on developments in various technologies. This impact is measured by examining the extent to which patented inventions build upon papers from IEEE journals, IEEE-sponsored conferences, and IEEE standards. This is an update of previous reports and examines US patents issued from January 1, 1999 through December 31, 2019.

The main findings of this report are:

- New technology continues to build upon science, and the dependence is increasing. In this study, the top 50 firms (in 2019) were granted 104,048 patents, which made a total of 802,837 non-patent references (an average of 7.71 non-patent references per patent). Back in 2010 the top 30 firms had 58,179 patents which made a total of 239,789 non-patent references (an average of 4.13 non-patent references per patent). Thus, the number of patents is trending upward but the number of references from those patents is rising at a greater rate. Since many these non-patent references are to scientific articles and conference papers, this suggests that today's technology developments are increasingly linked to developments in published science.
- A large portion of this science base comes from papers presented at IEEE sponsored conferences and published in IEEE journals. The top 50 patenting firms in 2019 have referenced over 2,035,036 articles in the last 21 years. About 28% (580,807) of those articles appeared in IEEE journals, IEEE sponsored conferences or IEEE Standards Documents.
- In this study, we also went beyond the top 50 patenting companies and analyzed all patents from the last 21 years in several technology categories of interest to IEEE members and customers. For example, 33.94% of all scientific references from Computer Hardware patents go to IEEE publications. The second most referenced publisher is ACM (Association for Computer Machinery) with 17.38% of the referenced publications. In other Information Technology areas, such as Information Storage, Semiconductor Manufacturing, and Computer Software, the results are similar.
- In Telecommunications technology, IEEE is particularly important. The 576,038 references to IEEE articles and conferences represents 42% of all science references from Telecommunications patents since 1999. To help put this in perspective consider: Telecommunications is a very technology driven industry and that technology is often built upon scientific discoveries published in journal and conference papers. If we consider this set of papers as the science base of telecommunications, than 42% of that science base is published in IEEE journals or presented at IEEE sponsored conferences. In addition, the 576,038 references to IEEE dwarf the combined total of the next 20 publishing organizations in this technology.

- Last year for the first time we examined three new technology categories: Blockchain and Distributed Ledgers, Cybersecurity, and Virtual and Augmented Reality. In these three emerging categories, IEEE continues to enjoy a two-fold lead over second place ACM.
- We also kept the three categories added for the first time in 2017: Artificial Intelligence (AI), Autonomous Vehicles, and Internet-of-Things related patents. In AI, IEEE enjoys a 3-fold lead over second place ACM. In Autonomous Vehicles, IEEE has a dominant lead (10-fold lead) over the second-place entry which is a conference sponsored jointly by IEEE and the Robotics Society of Japan, as well as a 10-fold lead over third place SPIE. And in the Internet-of-Things category, IEEE has a 5-fold lead over second place ACM.
- IEEE is referenced a surprising amount in areas which are not central to its mission.
 - For example, 8.22% of the science references from patents in medical devices go to IEEE publications. This ranks IEEE third behind RELX and Wiley (with 20.26% and 9.80% respectively). The latter publishers have hundreds of journals in the medical area, whereas IEEE has only a few, so the 8.22% figure is quite solid for a non-core area.
 - Optics is also somewhat surprising. IEEE publications receive the most references from Optics patents, and IEEE is referenced even more than the two large Optics Societies that would be expected to lead the area: OSA – The Optical Society of America, and SPIE – The International Society of Optical Engineering.
 - In Measuring, Testing, and Control, IEEE gets 20.30% of all references, which is just ahead of the 14.10% of RELX while, again, RELX has many more journal titles in the space.
 - In the Robotics and Intelligent Manufacturing category, 45.13% of the patent references are to articles published in IEEE journals or in proceedings of IEEE sponsored conferences. Second place RELX receives about one-sixth as many references in the category.
 - Patents related to Power Systems and Transmission also reference IEEE publications most frequently. The 51,900 references to IEEE journal and proceedings papers are more than the next two top referenced publishers (RELX and Electrochemical Society) combined. We also examined a specialized subset of the Power Transmission category related to smart meters and smart grids. In this category, 65.48% of the scientific references from patents go to IEEE journal or conference papers. The second most referenced publisher is RELX with only 5.51% of all references.

- Several years back we started tracking some green energy categories: Solar and Photovoltaic energy and Wind energy. In the latter category IEEE science has a big advantage over the other publishers with more than 42% of the references. In solar energy, IEEE has a small lead over RELX. RELX has more than 50 journal titles related to the area including several high impact journals such as *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, and *Solar Cells*, IEEE has only a few.
- In broadcasting technologies, IEEE leads with 37% of the references, which is almost 5 times as many as second place International Telecommunication Union. The latter produces standards documents while the IEEE references are to standards documents as well as peer reviewed scientific papers from journals and conferences.
- It has been shown that high-quality, high-impact, and valuable patents tend to be cited more frequently by later patents. Citation impact is thus often used as a quantitative measure for evaluating patents (see [3]). In this study, we found that the patents that reference IEEE papers are cited more often than patents that do not. This was shown to be true for each of the twenty technology categories we examined. This suggests that, not only do IEEE publications frequently provide the science base for new inventions, but that inventions that build upon IEEE publications are more likely to be valuable in the future than inventions that do not build upon IEEE.
- Although this study concentrates on patents in specific technology areas, it should be noted that the importance of scientific and technical literature to patented technology is increasing in all areas. Our research shows that the average US patent had only 2.76 non-patent references (NPRs) back in 1997. That number jumped to 11.31 by 2019 – a 310% increase. These numbers are for all issued US patents and not just those in the twenty categories covered in this report.¹ This means that in the overall patent system, patented technologies are increasingly referencing scientific articles.
- Since we only look at specific categories of technology plus the top 50 firms, there is no way to know exactly how much referencing to IEEE has increased since 1997. However, we can make an estimate for the whole patent system by identifying any Non-Patent References that mention “IEEE” or “I.E.E.E.” (This will of course miss things like the *Journal of Lightwave Technology* or *Spectrum*, which may not have IEEE in the reference, but it will be a reasonable estimate.) If we do a comparison as above, we find that there were just 14,635 patent references with IEEE or I.E.E.E in 1997, but 155,558 in 2019 (a 963% increase). Thus, science referencing and IEEE referencing have both increased greatly since 1997.

¹ Including science intensive areas like Biotechnology, Pharmaceuticals, Chemicals, and other areas where IEEE typically has little influence.

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I. Introduction

In previous studies, it was found that patents reference papers from IEEE journals much more often than papers from other journal publishers. In this report, we update the previous results, and study US patents issued from January 1999 through December 2019. Although this report is an update of previous results, we have made our best efforts to make this report self-contained. The aim of this report, as in previous reports, is to analyze references from patents to journal articles, conferences and standards documents, in order to assess IEEE's impact upon technological developments.

This report covers twenty subcategories of Technology where IEEE members and readers are active. Many, but not all, are related to Information Technology. The categories' patent counts are shown below in Table 1.

Table 1 – Number of Patents for Each Category Covered in this Study

Category	# Patents 1999-2019
AI/Artificial Intelligence	15110
Autonomous Vehicles	3573
Blockchain/Distributed Ledger	643
Broadcasting	178370
Computer Hardware	455690
Computer Software	266511
Cybersecurity	122255
Diagnosis/Surgery/Medical Instruments	232788
Information Storage	135459
IOT/Internet of Things	13410
Measuring, Testing and Control Devices	228934
Optics/Photography/Electrophotography	164146
Power Systems	127572
Robotics and Intelligent Manufacturing	35084
Semiconductors/Solid-State Devices/Electronics	304479
Smart Grid/Smart Meters/Energy Infrastructure	4599
Solar/Photovoltaic	14386
Telecom and Other Communications	656732
Virtual/Augmented Reality	13664
Wind Energy	7473

II. Methodology

This study is based on referencing patterns from patents to prior art documents. When an inventor files a patent for an invention, he/she will typically reference earlier documents to show that the new invention either builds upon, or improves upon, what came earlier. The inventor's patent attorney and/or the examiner may also add prior art references to either clarify or limit the claims of the invention.

As an example, Figure 1 shows the front page of a patent owned by IBM. The prior art references on this patent come in two forms - references to earlier patents, and “other references”. These other references are often to scientific publications, such as those produced by IEEE. In this report, we are primarily concerned with these other references, which are also sometimes called “Non-Patent References”.

It has been suggested that patents with many non-patent references are likely to contain new leading-edge ideas, whereas patents that only reference earlier patents are likely to be incremental improvements on earlier patented technologies. For a comprehensive study on various hypotheses surrounding the motivations of inventors in citing other references, see [1].

Patent Sets used in the Analysis

This study is based on two patent sets. Our analysis is based on determining the number of references from these patent sets to publications from publishers such as IEEE, RELX (formerly Elsevier), the American Institute of Physics, and others.

The first set contains patents from the top 50 patenting companies in 2019. Analysis of this patent set provides insight into how the top tier companies rely upon science from IEEE and other publishers. The second set contains all patents in twenty technology categories from all companies, universities, government agencies, and individuals. The twenty technology categories examined are shown in Table 1 above. Analysis of this patent set reveals the wider influence of IEEE science in these technologies.

Identifying Relevant Non-Patent References

Non-patent references can be to any published document, from comic strips and brochures, to scientific articles and standards documents. The main difficulty in identifying relevant non-patent references for a study such as this is that inventors do not use a standard form for listing references. As an example, Table 2 contains eight different variants for the IEEE Global Telecom Conference. Note that some inventors just use the GLOBECOM shorthand, while others list the entire name. Sometimes IEEE is mentioned and sometimes it is not. When abbreviation variations are included such as Telecom, Tele, Tcom, Proc., Proceed., the number of variants increases further. The same issue exists for variants in journal names and standards documents. For example, there are more than 30 variant spellings of the journal title *Journal Of Thoracic And Cardiovascular Surgery* including numerous mis-spellings of thoracic and every conceivable way of abbreviating cardiovascular.

Table 2 – Variants for IEEE Global Telecom Conference

Proceedings of Globecom '96
IEEE Global Telecommunications Conference
GLOBECOM '90:IEEE
Proceedings of IEEE Globecom '94
Globecom '97
IEEE Globecom, Global Telecommunications Conference and Exhibiton
Proc of the Global Tele Conf, U.S. New York, IEEE

Conference Identification – to identify conference proceedings among the non-patent references, we first identified references containing keywords such as meeting, symposia, conference, etc. We then used parsing software to identify 2-word and 3-word phrases that appear frequently in this set of papers. The full string was identified for these string subsequences in order to identify frequently cited conferences. In this way, we identified the top conferences referenced in the patent sets, and standardized the names of these conferences (i.e. all of the different variants of a conference were collected under a single name). As an example, all of the variants shown in Table 2 are assigned to the name ‘<conf> IEEE Global Telecommunications Conference (GLOBECOM)’.

We then looked up each of these conferences on the web to determine who is listed as their primary sponsor. For example, many of the conferences are sponsored by organizations such as IEEE, ACM (Association for Computer Machinery) and ASME (American Society of Mechanical Engineers). Some conferences are jointly sponsored by multiple organizations and this is noted as well.

When we first started identifying conferences in the 2005 report, we looked up the top 100 most referenced conferences in order to identify the primary sponsors or hosts. In this current report, we have identified the sponsors for the top 1,200+ most referenced conferences. These 1,200+ conferences are listed under more than 10,000 variant names.

Standards Identification – Standards documents are increasingly referenced, and in general they are easy to identify by looking for strings such as ‘standard’ or ‘std’. Once the records containing the standards were located, it is straightforward to identify the organization that produced each standard (ITU, IEEE, ISO, JEDEC, ANSI, etc.). Further, once the standards bodies are identified, we then identify references to other documents that do not specifically list the words ‘standard’ or ‘std.’ The latter step is necessary since some references look like this “ISO/TC97/SC21/N2066” or “IEEE802.3” without a specific mention of the word “standard.” Consequently, we also identify other non-standard documents released from these organizations including draft standards and “requests for comments” documents if patents cite them.

Journal Identification – identifying and standardizing journal names is a very difficult process because there are so many different journals, and their names can be abbreviated in many different ways. To make the problem more manageable, we base our analysis primarily to the 45,000+ journals covered by the combined databases of ISI/Thomson Reuters, Elsevier/SCOPUS, and 1790 Analytics, LLC. This is not a severe limitation, since these databases include more than 200 IEEE journals, transactions, and magazines, 3,000+ RELX/Elsevier journals, and 1,200 Wiley journals. In addition, we also identify publishers of about 1,000 non-ISI, non-SCOPUS journals if they appear very frequently in the patent references, but do not appear in these databases.

Once restricted to these 45,000+ journals, we used software that transforms journal names into common abbreviations and then implements string matching. Care must be taken with string matching because, for example, searching for “Urology Journal” will also accidentally identify “Neurology Journal”. Similarly, a search for the journal “Science” would accidentally pick up

any reference with ‘science’ in the paper title as well as any of the 800+ journals with science in their titles such as “Game and Wildlife Science”. Our proprietary software for journal identification (along with some human intervention) deals with all these problems, so that we generate an accurate match between the patent references and 45,000+ journals. After identifying all of the relevant journals, we then used the ISI and SCOPUS databases and web research to identify the publisher of each journal

III. Results

References from Top 50 Patenting Organizations

Table 3 shows the 50 firms that were granted the largest number of US patents in 2019. It should be noted that many of these firms consist of multiple subsidiaries, and these firms patent under many names. (For example, General Electric has patents filed under 316 names, of which only a fraction contain General Electric in the name.) We identified all the subsidiary names for each company to ensure that our patent counts are accurate.

We identified the top 50 patenting firms because we want to understand the extent to which the current technology leaders use IEEE science. Figure 2 shows the 20 publishers of science whose publications are referenced most frequently by the 50 firms shown in Table 3. This figure shows that patents issued to the top 50 firms between 1999 and 2019 reference IEEE papers, conferences, and standards more than 580,807 times. This is more than three times as many references as the second placed publisher ACM.

IEEE receives 28.5% of the science references from the patents of the top 50 companies. The next closest publisher (ACM) has 8.50% of the total. About 1/3 of the 580,000+ patent references to IEEE are to IEEE sponsored conferences.

Table 3 – Top-Patenting Firms in 2019

Rank	Full Parent Name	2019 Patent Count	1999-2019 Patent Count
1	International Business Machines Corp	9587	117322
2	Samsung Electronics Co Ltd	6825	80268
3	Canon Inc	4109	61822
4	Intel Corporation	3672	43365
5	Microsoft Corporation	3142	39107
6	Huawei Technologies Company Ltd.	2955	13776
7	General Electric Company	2856	41767
8	LG Electronics Inc.	2854	27508
9	United Technologies Corp	2771	18428
10	Sony Corp	2719	46061
11	Apple Inc	2525	19298
12	Ford Motor Co.	2521	16461
13	Amazon.com Inc.	2487	12034

14	Google Inc.	2457	21121
15	Toyota Motor Corp	2442	22698
16	Dell Technologies Inc	2432	16428
17	Qualcomm Inc	2396	26513
18	Samsung SDI Co Ltd	2358	20395
19	Taiwan Semiconductor Manufacturing Co.	2329	20068
20	BOE Technology Group Ltd	2187	6919
21	Panasonic Corporation	2065	50709
22	Ericsson	1624	19087
23	Siemens Aktiengesellschaft	1559	27607
24	Hyundai Motor Co.	1548	9090
25	Johnson & Johnson	1462	16908
26	AT&T Inc	1442	21901
27	Hon Hai Precision Industry Co. Ltd. (aka Foxconn)	1428	39050
28	Hitachi Ltd	1422	37547
29	Boeing Co. (The)	1416	13662
30	Toshiba Corp	1401	38778
31	Fuji Film Holdings Corp	1395	28501
32	Medtronic Inc	1376	20508
33	Seiko Epson Corporation	1348	24660
34	Mitsubishi Electric Corp	1335	20315
35	General Motors Corp	1316	17238
36	Bosch (Robert) GmbH	1283	20396
37	Micron Technology Inc.	1280	27657
38	Denso Corp	1223	17340
39	Fujitsu Limited	1214	32372
40	Honda Motor Co. Ltd.	1115	18351
41	Kyocera Corp.	1110	10142
42	Cisco Systems Inc.	1109	16003
43	Halliburton Co. (Holding)	1104	7877
44	NEC Corp	1070	24367
45	Koninklijke Philips N.V.	1061	20006
46	Honeywell International Inc.	1031	19028
47	Facebook Inc	1020	3839
48	Ricoh Co. Ltd.	998	20285
49	TCL Corp	937	4784
50	HP Inc	931	30178

Table 4 illustrates the reference distribution of IBM, which is the top patent holder in 2019 (and for the past 15 years). This reference distribution is typical of the top 50 firms. The references from IBM to IEEE are to a number of different IEEE journals and conferences. In this table, IEEE journals are highlighted in yellow and IEEE conferences are highlighted in orange. The top overall reference to IEEE is to the International Electron Device Meeting. The top IEEE journals are *IEEE Computer Magazine* and *IEEE Transactions on Electron Devices*.

Table 4 – Reference Distribution from IBM Patents 1999-2019

References	Journal/Conference/Standard
6086	IP.Com Prior Art Database tech Disclosure
4733	Misc ACM
3286	IEEE Unseparated
2960	IEEE Int Electron Devices Meeting (IEDM)
2797	IBM JOURNAL OF RESEARCH AND DEVELOPMENT
2618	ACM SIGPLAN Notices
2400	APPLIED PHYSICS LETTERS
2299	COMMUNICATIONS OF THE ACM
2259	Proceedings of ACM SIGMOD
2201	IETF Network Working Group
1752	Int Conf on Very Large Data Bases (VLDB)
1692	IETF Document
1617	IEEE tr ELECTRON DEVICES
1512	NIST Document
1438	JOURNAL OF APPLIED PHYSICS
1407	Computer (IEEE)
1396	USENIX Conference Proceedings
1389	IEEE int conf on Data eng (ICDE)
1386	IETF Std
1367	IEEE/JPN Soc App Phys - symp on VLSI tech
1314	ACM/IEEE Design Automation conf
1311	Proc ann IEEE ACM int symp on Microarchitecture (MICRO)
1295	IEEE JOURNAL OF SOLID-STATE CIRCUITS
1267	ACM/IEEE int symp on comp Architecture (ISCA)
1244	IBM SYSTEMS JOURNAL
1240	Proc SPIE
1179	ACM SIGOPS
1139	IEEE ELECTRON DEVICE LETTERS
1117	IEEE tr COMPUTERS
955	JOURNAL OF THE ACM
894	ACM Conference on Human Factors in Computing Systems (CHI)
886	comp Architecture News
840	IEEE int Symp on High Performance Distributed comp
834	IEEE tr MAGNETICS
804	J Vac Sci tech
747	IEEE tr Software eng
739	IEEE Int Conf Acous, Speech, and Sig Proc (ICASSP)
724	SCIENCE
714	IEEE int conf on Distributed comp sys
707	IEEE tr comp Aided Design of Integrated Circuits and sys
700	IEEE int symp On High Performance comp Architecture (HPCA)
684	Proceedings ACM SIGCOMM Symp
680	IEEE tr PARALLEL AND DISTRIBUTED SYSTEMS
650	IEEE Proceedings
650	IEEE tr KNOWLEDGE AND DATA ENGINEERING
637	IEEE Misc Conf
636	IEEE/ACM Int Conf on Software eng (ICSE)
610	proc IEEE int Solid State Circuits Conf (ISSCC)
601	IEEE Electronic Components and tech conf
576	IEEE Hawaii Int Conf on Sys Sci (HICSS)
571	International World Wide Web Conference
569	IEEE tr INFORMATION THEORY
561	ACM Conf On Architectural Support for prog Languages and Operating sys (A
554	ACSA/IEEE ann comp Security app conf (ACSAC)
543	IEEE/ACM int conf on comp Aided Design (ICCAD)
534	IEEE/ACM Proceedings on Supercomputing (SUPERCOMP)
530	Network Working Group RFC
518	NATURE
515	IEEE MICRO
511	IEEE International Parallel and Distributed Processing Symposium

Notice that 33 of the top 60 journals and conferences referenced by IBM patents are published or sponsored by IEEE. Thirteen of the top 60 journals and conferences are published or sponsored by ACM. As a software firm, IBM tends to reference ACM much more than most of the top 50 firms, but still IBM references IEEE twice as often as ACM as seen in Appendix A-11 (54,707 references to IEEE and 29,514 references to ACM.) The reader may notice the large number of references to ‘IEEE Unseparated’ or ‘Misc ACM’ in Table 4. These are articles that reference IEEE or ACM, but the inventor has not given a reference specific enough to identify the proper journal or conference. A few examples can be found in Table 5 below. These are relatively complete references; it is not clear why the inventors were not more careful about listing the full journal names.

Table 5 – Examples of References Mapped to “IEEE Unseparated”

Patent	NPR #	NPR Text
05692177	3	Lewis et al. "Hashing for dynamic and static internal tables." IEEE, pp. 45-56 Oct. 1988.
05699518	4	"The Design and Implementation of a Reliable Distributed Operating System--ROSE", Ng, IEEE, pp. 2-11, Apr. 1990.
05699518	5	"A service Platform for Distributed Applications", Popescu-Zeletin et al, IEEE, pp. 11-17, Jul. 1992.
05709219	5	Kotoku, Tetsuo et al., "Environment Modeling for the Interactive Display (EMID) Used in Telerobotic Systems," IEEE Nov. 3-5 1991, pp. 999-1004.
05709219	6	Kotoku, Tetsuo, "A Predictive Display with Force Feedback and Its Application to Remote Manipulation System with Transmission Time Delay," IEEE Jul. 7-10 1992, pp. 239-246.
05709219	8	Burdea, Grigore et al., "Distributed Virtual Force Feedback," IEEE May 2, 1993, Atlanta, GA, pp. 25-44.

References from Companies in Twenty Technology Categories

In the previous section, we analyzed the use of IEEE science by the top patenting organizations. Out of all science publishers, IEEE was cited most often by these organizations by a wide margin. However, looking only at the top companies tells an incomplete story. IEEE publishes journals and runs conferences mainly in information technology, electronics and other areas. It is therefore useful to examine the extent to which IEEE science is referenced by all organizations that patent in specific technologies and not just the leading companies.

As mentioned in the methodology section, we identified all patents in the twenty technology categories shown above in Table 1. 1790 Analytics has developed a classification scheme that categorizes all patents into 50 broad technology areas based on International Patent Classes (IPCs) and Cooperative Patent Classes (CPCs) which are assigned to each patent as part of the examination process. This scheme was used to identify all relevant patents for the current analysis.

We examined each of the technology areas separately, and the results are summarized in Figures 3-19. The first category shown (in Figure 3) is Artificial Intelligence (AI). We identified all non-patent references on patents related to this technology issued between 1999 and 2019. We then determined the science publishers responsible for the largest number of these non-patent references. Figure 3 shows the result of this analysis, namely that IEEE science is referenced far more in AI related patents than science from any other publisher. Thirty eight percent of all science references from these patents go to IEEE journal papers or IEEE sponsored conference papers (the graphs also include standards documents, but the vast majority of the references are to journal or conference papers). In second place is the ACM with 12.19% of the references.

AI is currently a very hot area and often written about in the popular press. The same can be said for the Autonomous Vehicles category, which is shown in Figure 4. Here again IEEE dominates in references. In this case more than half (63.61%) of all references are to IEEE in this category.

Blockchain and Distributed Ledgers is a relatively new category added just last year. It has only a few hundred patents (as opposed to AI, which is a much more established category with 10,000+ patents). We see in Figure 5 though that 43.33% of all science references from these patents go to IEEE.

Figure 6 covers Broadcasting patents, which is a category we first added in 2015. This category consists of US patents in the IPCs for Broadcast Communication and Pictorial Communication (Television). It would seem that this would be an area that is somewhat tangential to IEEE's core mission. However, 37% of all science references from these patents go to IEEE journal papers or IEEE sponsored conference papers. The International Telecommunications Union is a distant second with 8.12% of all references.

Figures 7 and 8 show referencing patterns from Computer Hardware and Software patents. Here IEEE once again receives far more references than the other publishers. In both cases, ACM is the second most referenced publisher, but it receives about half of the references that papers published by IEEE receive.

Figure 9 shows references in the fast-growing area of Cybersecurity. This is a very hot area with a lot recent patent growth, and again IEEE leads by a wide margin (30.41% of all references compared to 15.27% for second place ACM).

Figure 10 examines the top referenced publishers in the Medical Device field, which covers devices as well as diagnostic tools and surgical instruments. Here, IEEE is a respectable third in an area that is somewhat outside its core competency. RELX who has more than 400 journals in the field, such as *Annals of Thoracic Surgery*, and the *Journal of the American College of Cardiology* has a substantial lead with 20.26% of all references. Wiley with 9.80% is just ahead of IEEE with 8.22% of all references.

Figure 11 contains the results for the information storage category. In this area, IEEE is particularly dominant. 44.23% of all of the science references from patents in information storage are to papers in IEEE journals or conferences. IEEE's 84,675 references in this category is about six times as many as second place American Institute of Physics (AIP).

Another hot technology area consists of Internet-of-Things patents. As Figure 12 shows, IEEE science is very important to the development of this new and active area of patenting. More than 46% of all science references are to IEEE content. ACM is a distant second with 9.24% of all references.

Figure 13 contains the results of patents covering Measuring, Testing, and Control technology. Patents in this category are related to measuring or testing, force, pressure, weight, etc. as well as chemically measuring substances (e.g. measuring CO2 levels). The category also contains control devices since these technologies are often combined. For example, a patent might be related to a valve that adjusts at a certain pressure or at a certain pollution level. Since this type of measuring can be done both mechanically, magnetically, electrically, or chemically, it is not too surprising to see both IEEE and RELX and the Optical and Chemical Societies all near the top of Figure 13. IEEE receives the most references, but the lead is not as dominant as in the Information Technology related technology areas.

The results for the Optics category can be found in Figure 14. This is another area that is slightly outside the IEEE core. IEEE still has a lead over the second and third place publishers – the Optical Society of America (OSA) and the International Society of Optical Engineering (SPIE). Since these latter two societies are Optical societies, it would be reasonable to assume that one of these societies would lead in the category, but IEEE’s strong journals and conferences in the area receive more references from optics patents.

Figure 15 contains results for the patents related to power generation and transmission. Although this is a non-information technology category, IEEE leads in references in this category as well. 35.04% of science references from patents in this category go to IEEE publications. RELX is second with 20.68% of all US patent references in the category.

Intelligent Manufacturing and Robotics contains patents related to robotics, and robotics and control systems related to manufacturing. According to Markets and Markets, the Robotics market is about a \$20 billion dollar industry because of a population explosion in “service robots” that mow lawns, vacuum floors, and manufacture things.

As this industry grows, new innovations will be patented, and from Figure 16 it looks like those innovations will build upon ideas published in IEEE journal articles or presented at IEEE conferences. We see in that 45.13% of all science references from patents in this space refer to IEEE published articles. RELX is the second ranked publisher, but its papers receive only 7.70% of the science references. In this category, IEEE has more references than the next 15 publishers combined.

Figure 17 shows that IEEE is also very strong in the Semiconductor category. Here, the inclusion of conferences gives IEEE a substantial boost. Approximately one-third of the references to IEEE are to conference papers. With conferences excluded, IEEE would be about the same level as the American Institute of Physics in terms of science references from semiconductor patents.

The Smart Meter/Smart Grid category covers patents related to improving the power grid as well as for advanced residential electric meters. This is a relatively small category but as we see in Figure 18, the IEEE provides the bulk of the science base with almost 65% of all patent references.

Solar and Photovoltaic energy results are contained in Figure 19. IEEE holds a small lead over RELX in this category in spite of having fewer journal titles. RELX has several strong journals in this category including *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, *Solar Cells*, plus more than 50 smaller journal titles related to this technology. The references to IEEE science in this category mainly go to the *IEEE Photovoltaic Specialists conference*, the *IEEE World Conference on Photovoltaic Energy Conversion*, and *IEEE Transactions on Electronic Devices*.

The Telecommunications category is one of the strongest large categories for IEEE. There are about three times as many references to IEEE conference and journal papers as to second place publisher 3GPP (which is a standards body). Standards are referenced more frequently in telecommunications, but still not nearly as often as journal and conference papers. About 55% of the nearly one million total references to all publishers are to journal articles; 25% of the references are to conference papers, and about 20% are to standards documents. In terms of standards documents, the 3GPP General Partnership Project, Internet Engineering Task Force and International Telecommunication Union received the most references in the category. New telecommunications patents are referencing scientific articles to a larger extent than in the past. In last year's report, this figure showed 529,000 references to IEEE papers. Now as we see in Figure 20, there are more than 576,000 references to IEEE for telecommunications patents from 1999-2019. Thus in a category that averages 27,000 IEEE references per year, nearly 50,000 were added in 2019.

Standards documents are referenced increasingly often in Telecommunications patents. Six of the top 20 referenced publishers are standards bodies. Moreover, of the 576,000+ references to IEEE, over 20,000 are to various IEEE standards (mostly to the IEEE 802 family of standards).

Virtual and Augmented Reality is another relatively small but hot category. We see in this category that again IEEE leads by a wide margin with 39.61% of all science references from patents. ACM is in second place with 19.91% of references.

Wind Energy is another relatively small area where IEEE has a big lead. We see in Figure 22 that in this area 42.12% of all science references from Wind Energy patents go to IEEE journal and conference papers. This is four times as many references as second place RELX receives, in spite of having fewer journal titles in the area than RELX does.

Figures 3-22 show aggregate counts of references from all patents in each technology category. Readers who wish to see the firms that reference IEEE publications in each category can consult Appendix B. This appendix contains the 100 organizations that reference IEEE most frequently in each category. Appendix C is similar, except that it contains the organizations that reference IEEE most frequently in the twenty technology categories combined.

Citation Index for Patents Referencing IEEE

In an earlier study (see [2]), it was shown that patents that reference specific IEEE journals perform better on a number of quality metrics. Moreover, it was shown that the results were statistically significant. In this report, we update a key figure from the previous study showing the citation index of patents that reference IEEE papers versus peer patents that do not reference IEEE.

The citation index is a normalized citation metric that takes the number of citations received by a particular set of patents and divides it by the expected number of citations for patents of the same age and technology class. A random set of patents therefore should have a citation index of 1.0. Research has shown that patents cited by many later patents tend to contain important ideas upon which the later patents are building (see [3] and [6]). Citation indicators are also the basis for the patented financial models (see [4] and [7]) invented by the two 1790 founders Breitzman and Thomas.

Figure 23 contains the Citation Index for the patents in the twenty technology categories that reference IEEE papers and conferences. Also shown is the Citation Index for the set of the remaining patents in each category that do not reference IEEE. Note that the set of all patents in each category have an expected citation index of 1.0. Thus we see that the patents that reference IEEE are cited at least 30% more than expected, while the patents that do not reference IEEE are cited up to 30% less often than expected in some categories. This of course does not imply that all patents that reference IEEE are likely to be more valuable than patents that do not reference IEEE, but it does suggest that in general, patented technologies that build upon IEEE published or sponsored science are more likely to be valuable than patented technologies that do not reference IEEE science.

IV. Conclusions

When a patent is filed, it must reference the prior art upon which it builds, as well as any prior art that limits the claims of the new invention. This study and prior studies show that science published by IEEE forms a significant portion of this prior art for new patents.

In this study, we examined two separate patent sets. The first patent set consisted of patents granted between 1999 and 2019 to the 50 organizations with the largest number of US patents granted in 2019. The second patent set consisted of all US patents granted between 1999 and 2019 patents in twenty key technologies: Artificial Intelligence, Autonomous Vehicles, Cybersecurity, and several other categories. In both of these patent sets IEEE is the dominant source of non-patent prior art. In other words, IEEE journals and conferences are key outlets for scientific discoveries relevant to cutting edge technology.

Finally, we conducted an analysis of citation indices for IEEE related patents and non-IEEE related patents. These types of metrics have been shown in validation studies to be good markers for the quality, impact, and potential value of patents [3]. In this study, it was shown that patents that build upon IEEE published science tend to have higher citation indices than patents that do not reference IEEE. This suggests but does not guarantee that patents that build upon IEEE

science are more likely to become high-quality, high-impact, valuable inventions than patents that do not build upon IEEE.

Specific key results are identified in the Executive Summary.

V. References

- [1] Branstetter, Lee. "Is Academic Science Driving a Surge in Industrial Innovation? Evidence from Patent Citations," Columbia Business School, Discussion Paper #28.
- [2] Breitzman, Anthony. "IEEE and Patents: An Analysis of Patent Referencing to IEEE Papers, Conferences and Standards", 1790 Analytics, LLC, May 23, 2005
- [3] Breitzman, Anthony and Moguee, Mary Ellen. "The Many Applications of Patent Analysis," *of Information Science*, 28, 3, 187-205, 2002.
- [4] Breitzman, Anthony and Narin, Francis., "Method and Apparatus for Choosing a Stock Portfolio, Based on Patent Indicators," US Patent #6,175,824, Jan. 16, 2001.
- [5] Fortune Magazine, "Ten Tech Trends," January 10, 2005.
- [6] Hall, Bronwyn H., Jaffe, Adam B. and Trajtenberg, Manuel., "The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools" (December 2001). CEPR Discussion Paper No. 3094.
- [7] Thomas, Patrick., "System and Method for Producing Technology-Based Price Targets for a Company Stock," US Patent #6,832,211, Dec. 14, 2004.

Figure 1: Sample Patent Front Page

United States Patent
Bulzacchelli, et al.

7,822,114
October 26, 2010

Decision feedback equalizer using soft decisions

Abstract

A decision feedback equalizer (DFE) and method include at least two paths. Each path includes the following. An adder is configured to sum an input with a first feedback tap fed back from a different path. A latch is coupled to the adder to receive a summation signal as input. The latch includes a transparent state, and an output of the latch is employed as the first tap in a feedback path to an adder of a different path, wherein a partially resolved first tap in the feedback path is employed during the transparent state to provide a soft decision to supply correction information in advance of a hard decision of the latch.

Inventors: Bulzacchelli; John F. (Yonkers, NY), Friedman; Daniel J. (Sleepy Hollow, NY)
Assignee: International Business Machines Corporation (Armonk, NY)
Appl. No.: 11/761,586
Filed: June 12, 2007

Current U.S. Class: 375/233; 375/229
Current CPC Class: H04L 25/03057 (20130101); H04L 25/067 (20130101)
Current International Class: H03H 7/30 (20060101)
Field of Search: 375/233,229

References Cited

U.S. Patent Documents

7106099	September 2006	Nix
7539243	May 2009	Toifl et al.
2006/0188043	August 2006	Zerbe et al.

Other References

Grozing, "Sampling Receive Equalizer with Bit-Rate Flexible Operation up to 10 Gbit/s," Proceedings of the 32nd European Solid-State Circuits Conference, 2006, ESSCIRC 2006, Sep. 2006 pp. 516-519. cited by examiner.

Kenney, "A parallel architecture for multilevel decision feedback equalization," **IEEE Transactions on Magnetics**, vol. 34, Issue 2, Part 2, Mar. 1998 pp. 588-595. cited by examiner.

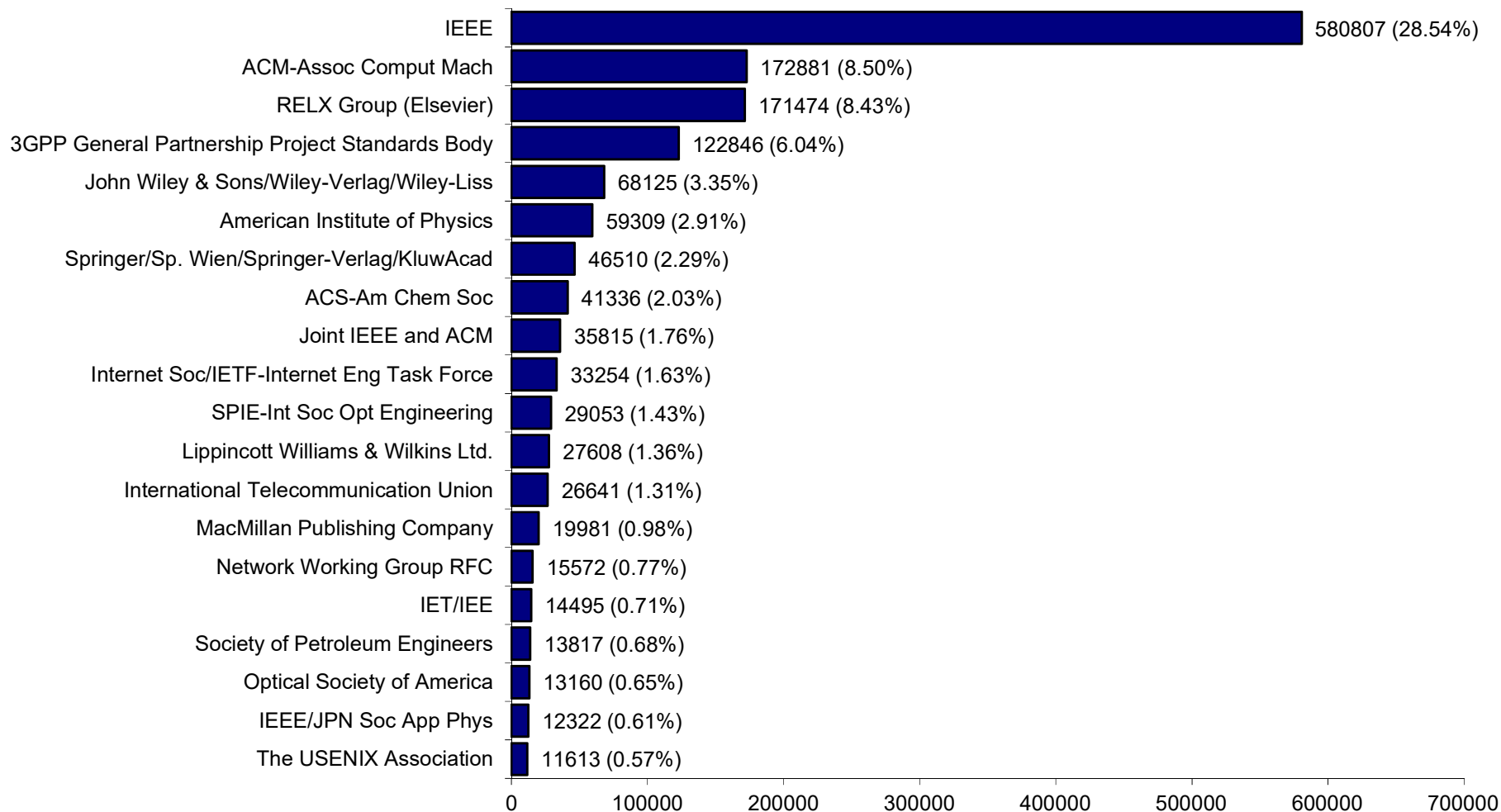
Kenney, "Pipelining for speed doubling in MDFE," 1996 **IEEE International Conference on Communications**, 1996, ICC 96, Conference Record, Converging Technologies for Tomorrow's Applications, vol. 1, Jun. 23-27, 1996 pp. 561-565 vol. 1. cited by examiner.

Varzaghani, "A 6-GSamples/s multi-level decision feedback equalizer embedded in a 4-bit time-interleaved pipeline A/D converter," **IEEE Journal of Solid-State Circuits**, on pp. 935-944, vol. 41, Issue: 4, Apr. 2006. cited by examiner.

Krishna, "A multigigabit backplane transceiver core in 0.13-.mu.m CMOS with a power-efficient equalization architecture," **IEEE Journal of Solid-State Circuits**, pp. 2658-2666, vol. 40, Issue: 12, Dec. 2005. cited by examiner.

Ren, "Performance Analysis of Edge-based DFE", Electrical Performance of Electronic Packaging Oct. 2006 pp. 265-268. cited by examiner.

Figure 2 - # and % of US Patent References from Top 50 Companies to Top 20 Journal Publishers



and % References to Papers/Standards/Conferences from 1999-2019 Patents

Figure 3 - # and % of Science References from 1999-2019 Artificial Intelligence US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

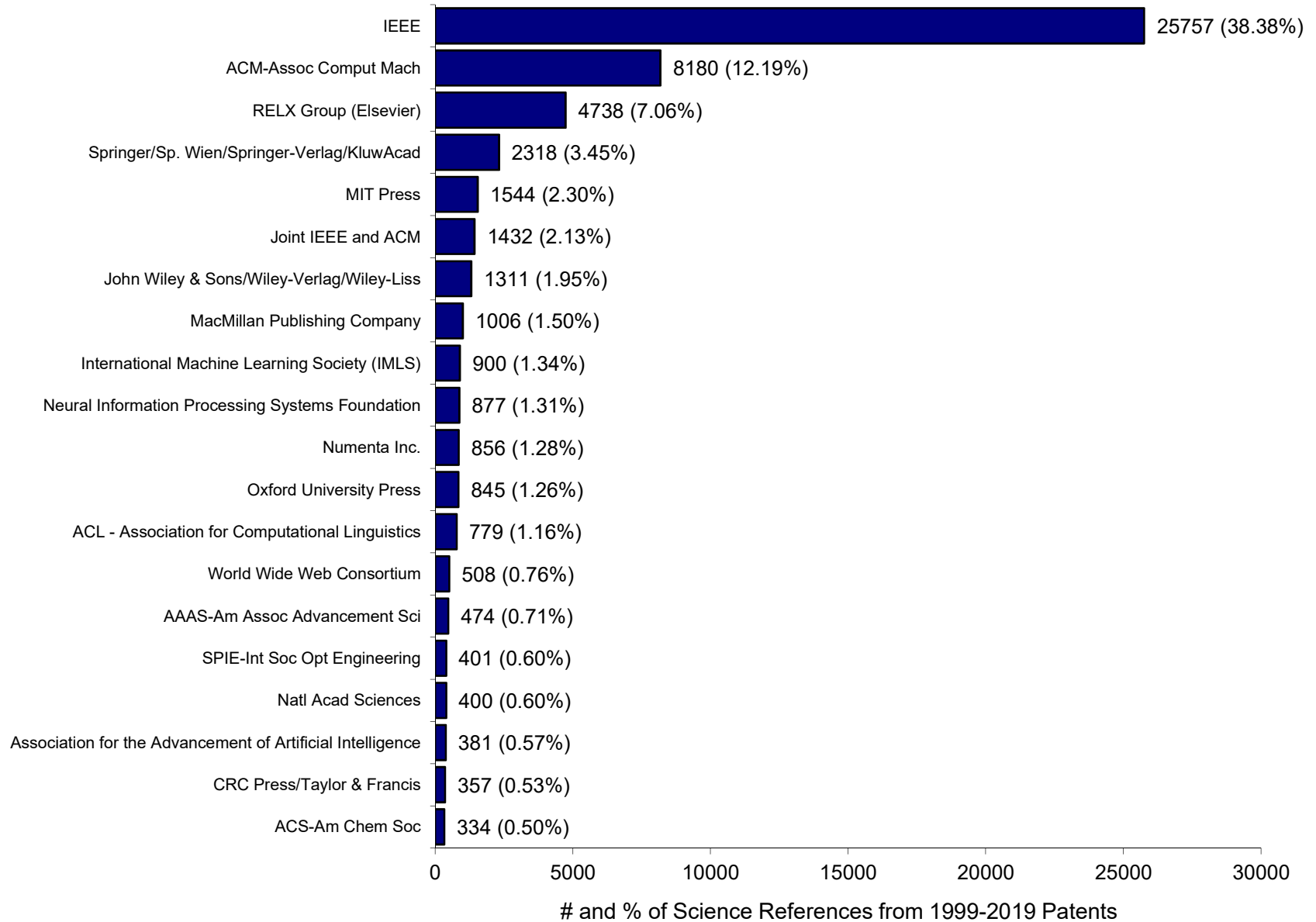


Figure 4 - # and % of Science References from 1999-2019 Autonomous Vehicle US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

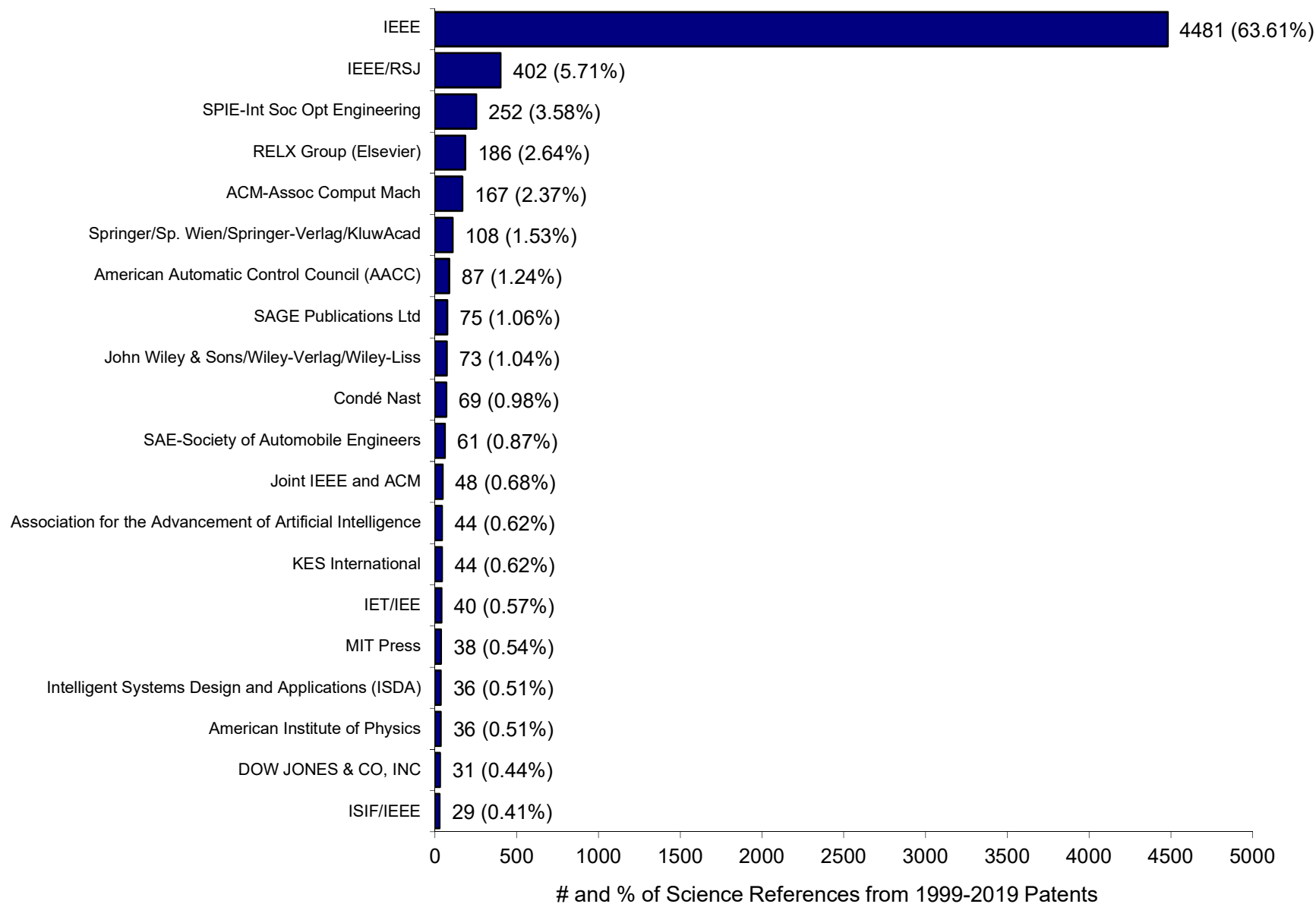
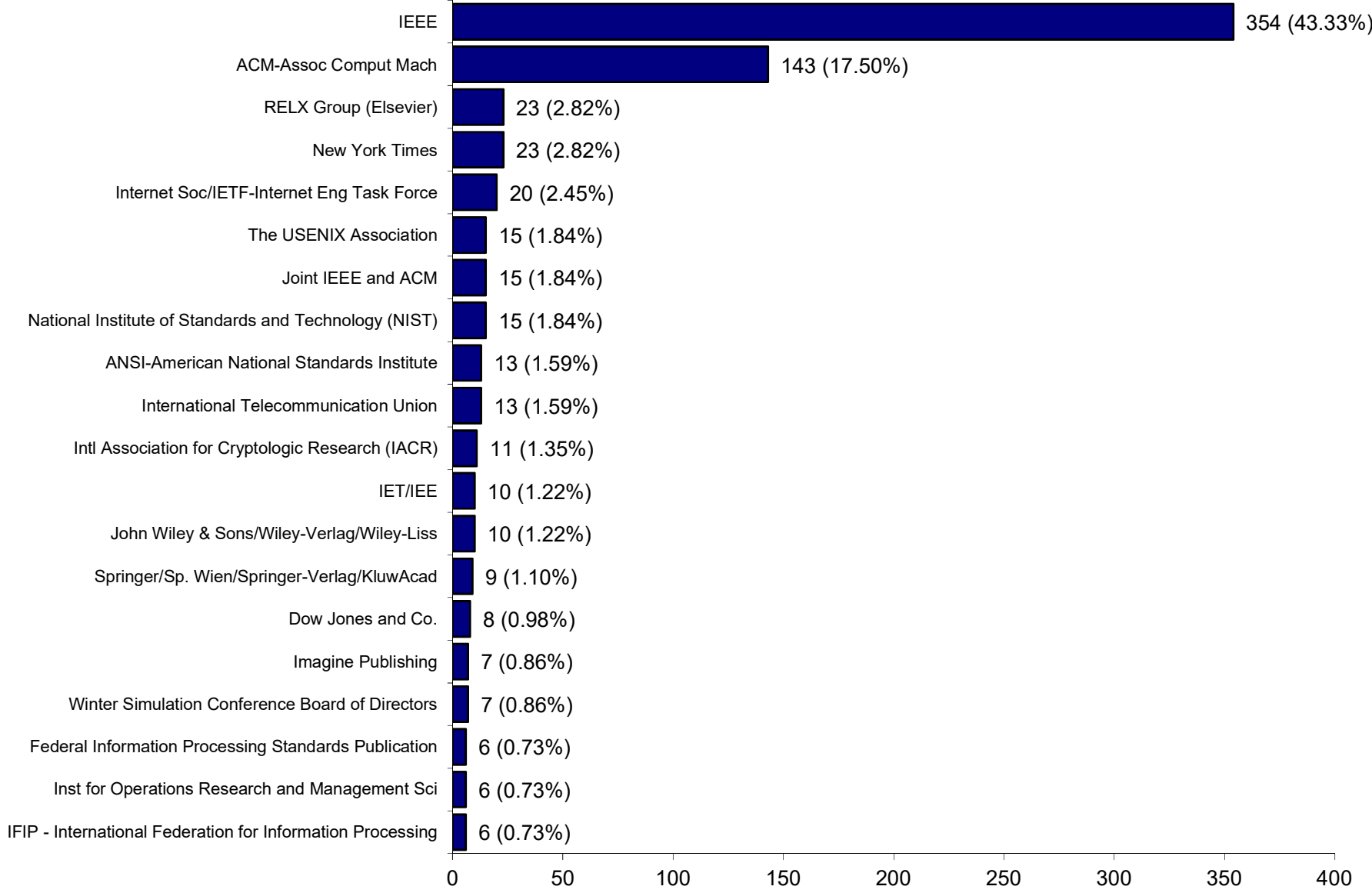
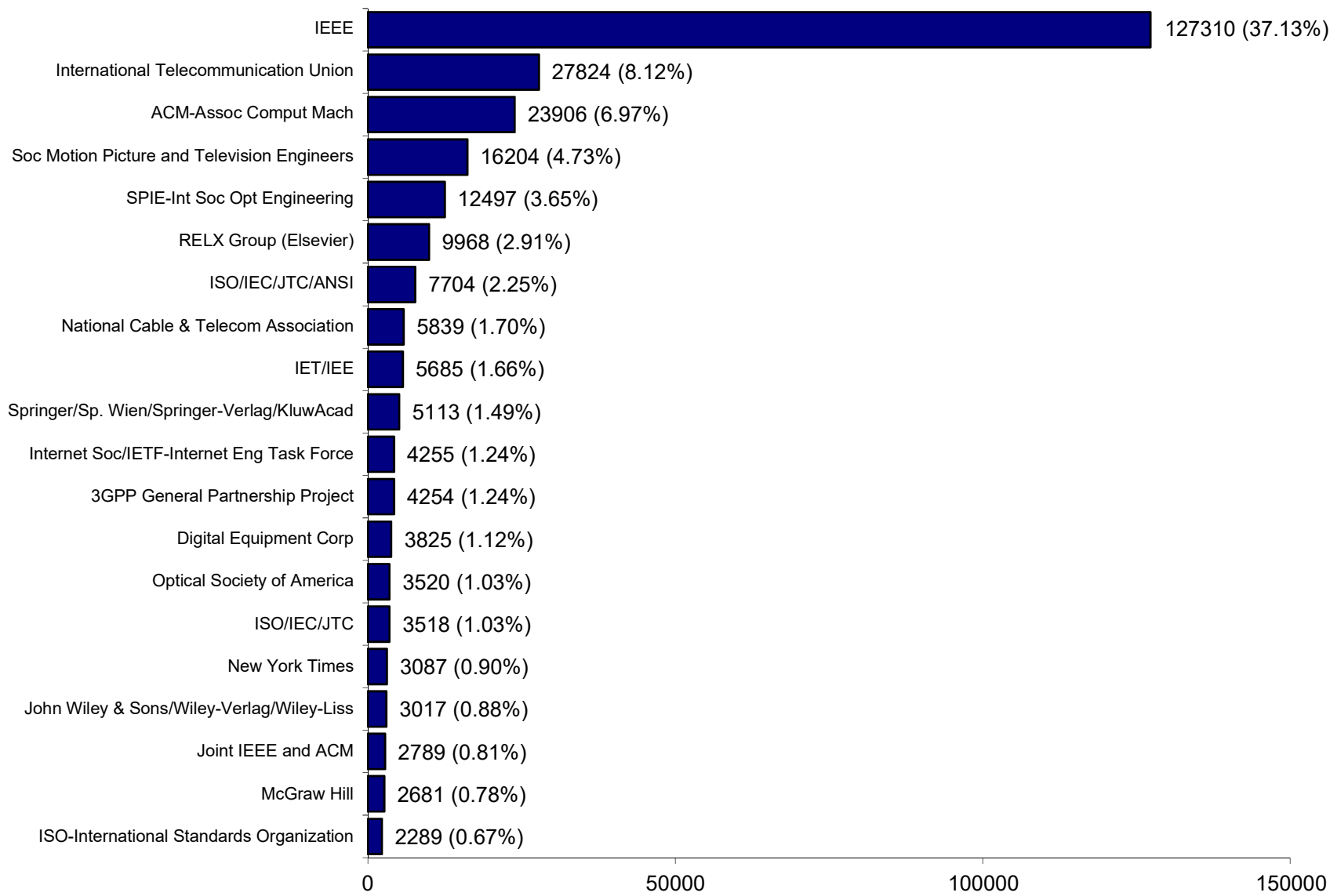


Figure 5 - # and % of Science References from 1999-2019 Blockchain/Distributed Ledger US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 1999-2019 Patents

Figure 6: # and % of Science References from 1999-2019 Broadcasting US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 1999-2019 Patents

Figure 7 - # and % of Science References from 1999-2019 Computer Hardware US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

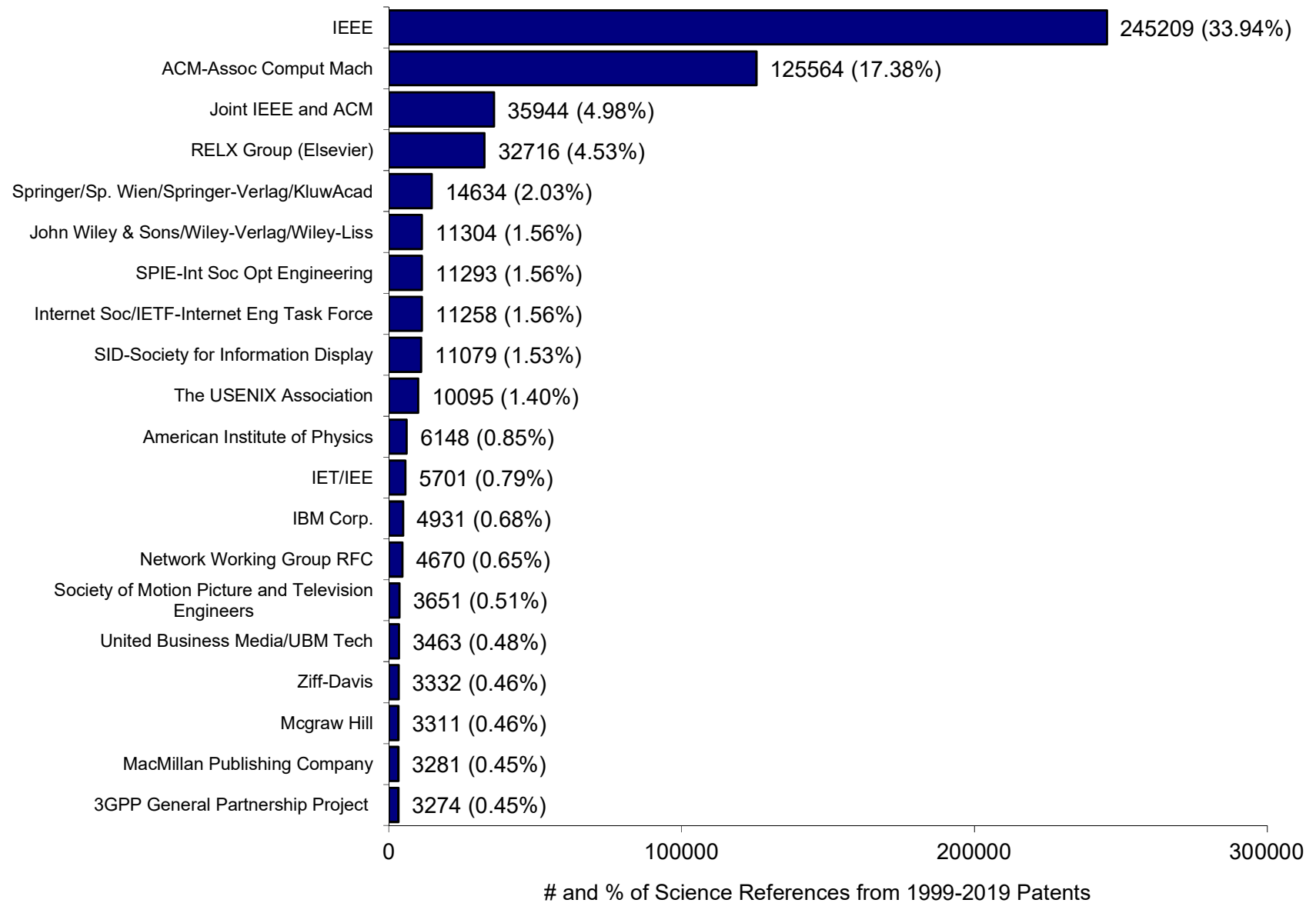


Figure 8 - # and % of Science References from 1999-2019 Computer Software US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

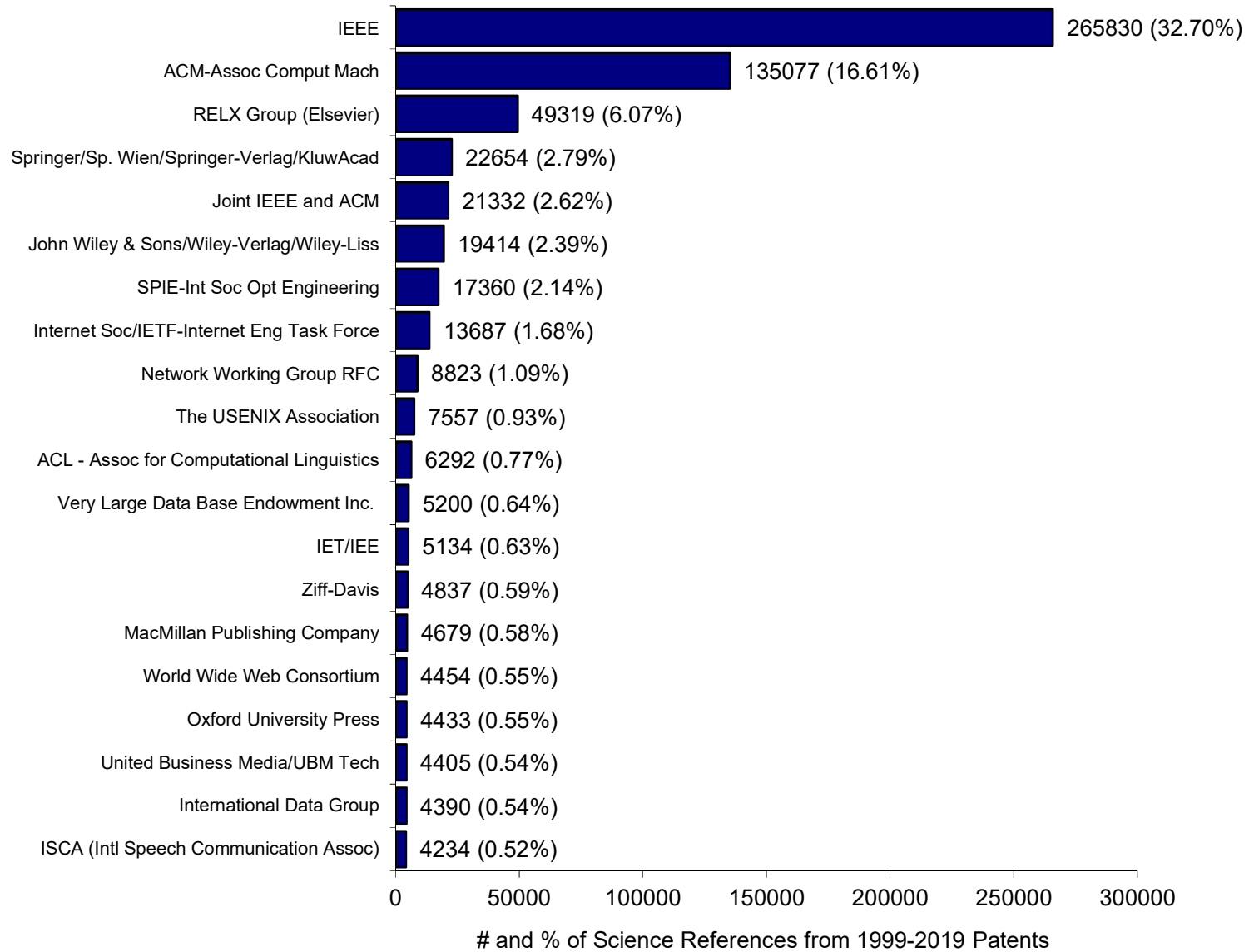
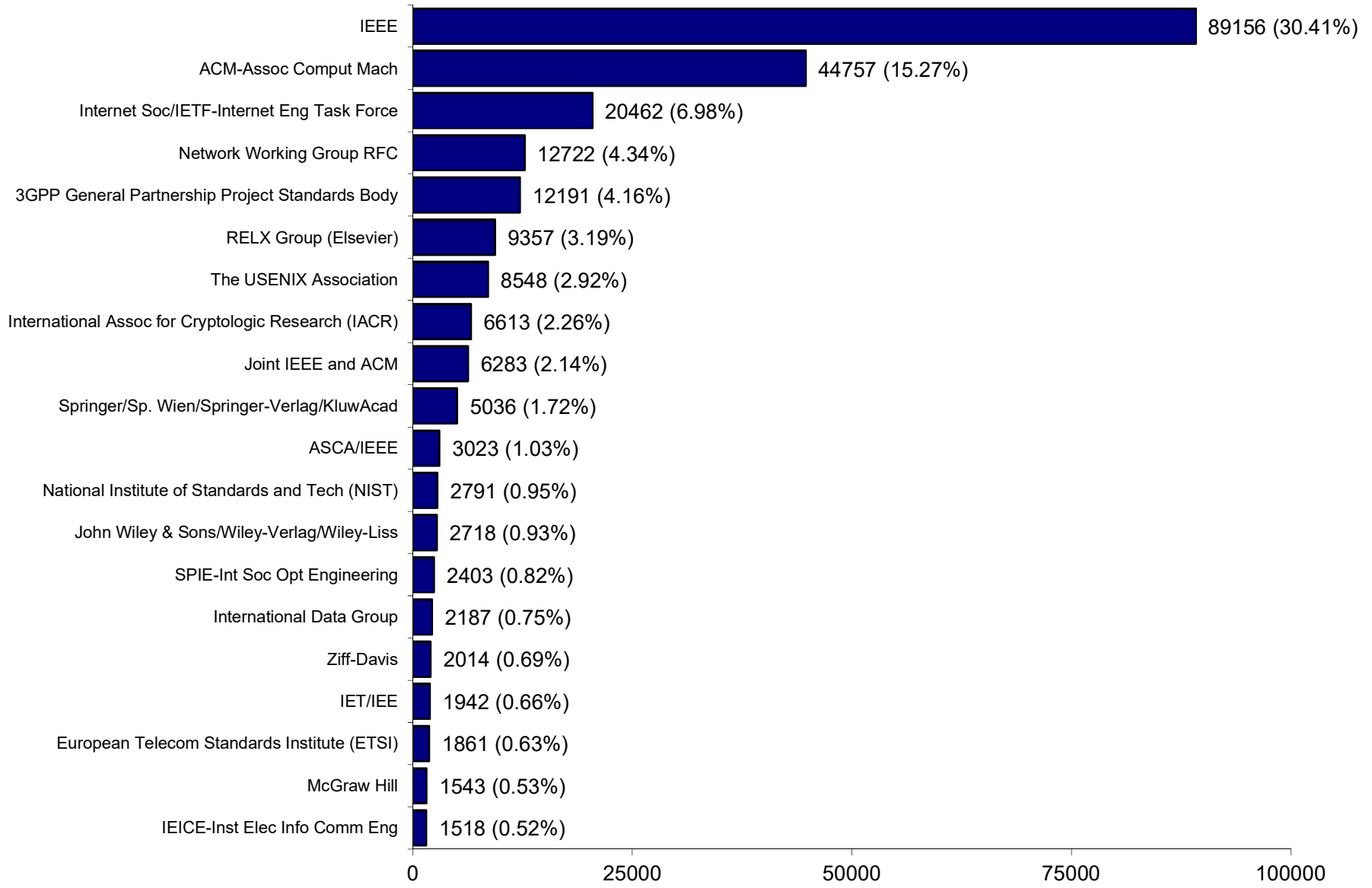


Figure 9 - # and % of Science References from 1999-2019 Cybersecurity US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 1999-2019 Patents

Figure 10 - # and % of Science References from 1999-2019 Medical Device US Patents to Top 20 Publishers and Conference Organizers

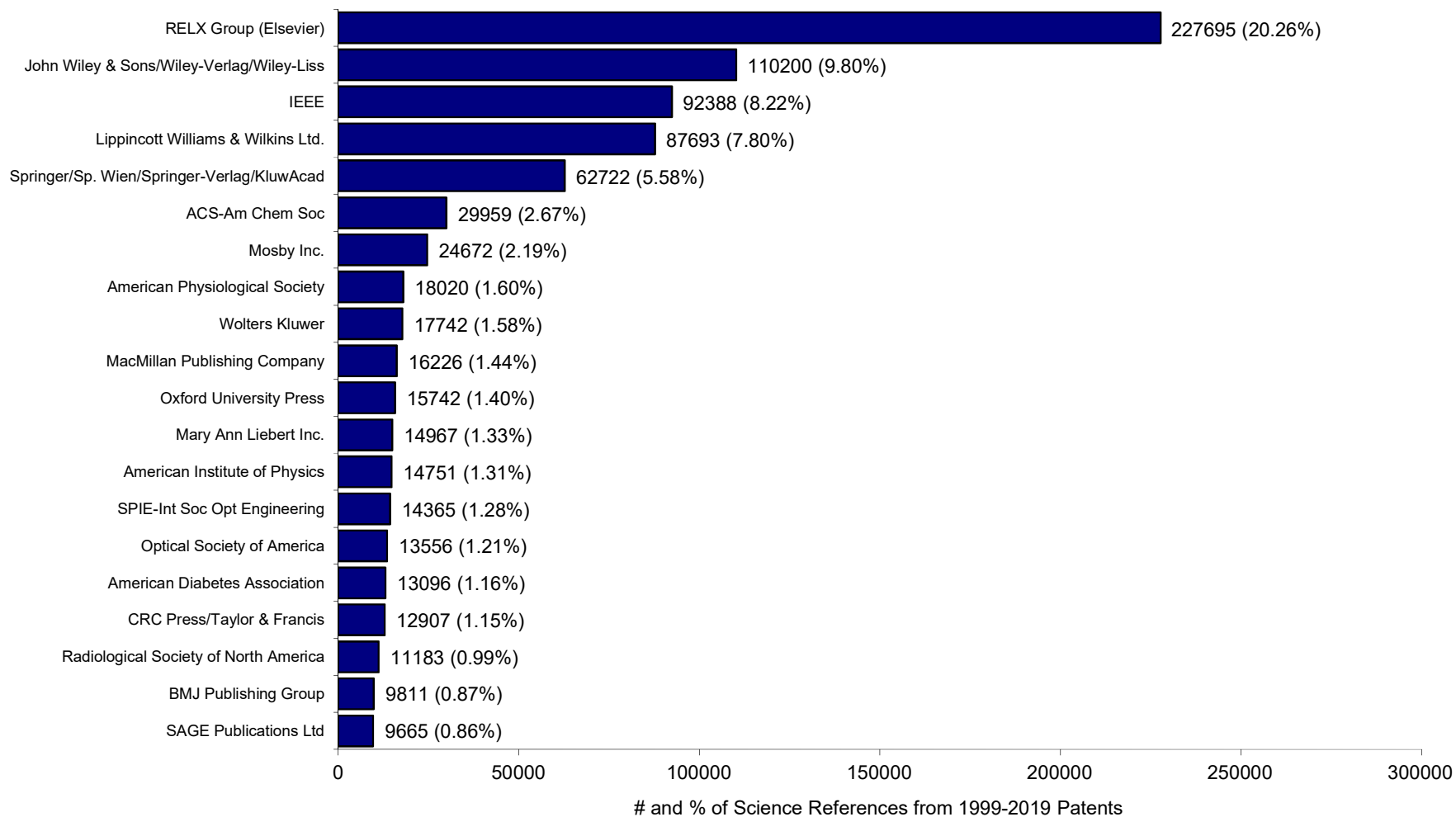


Figure 11 - # and % of Science References from 1999-2019 Information Storage US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

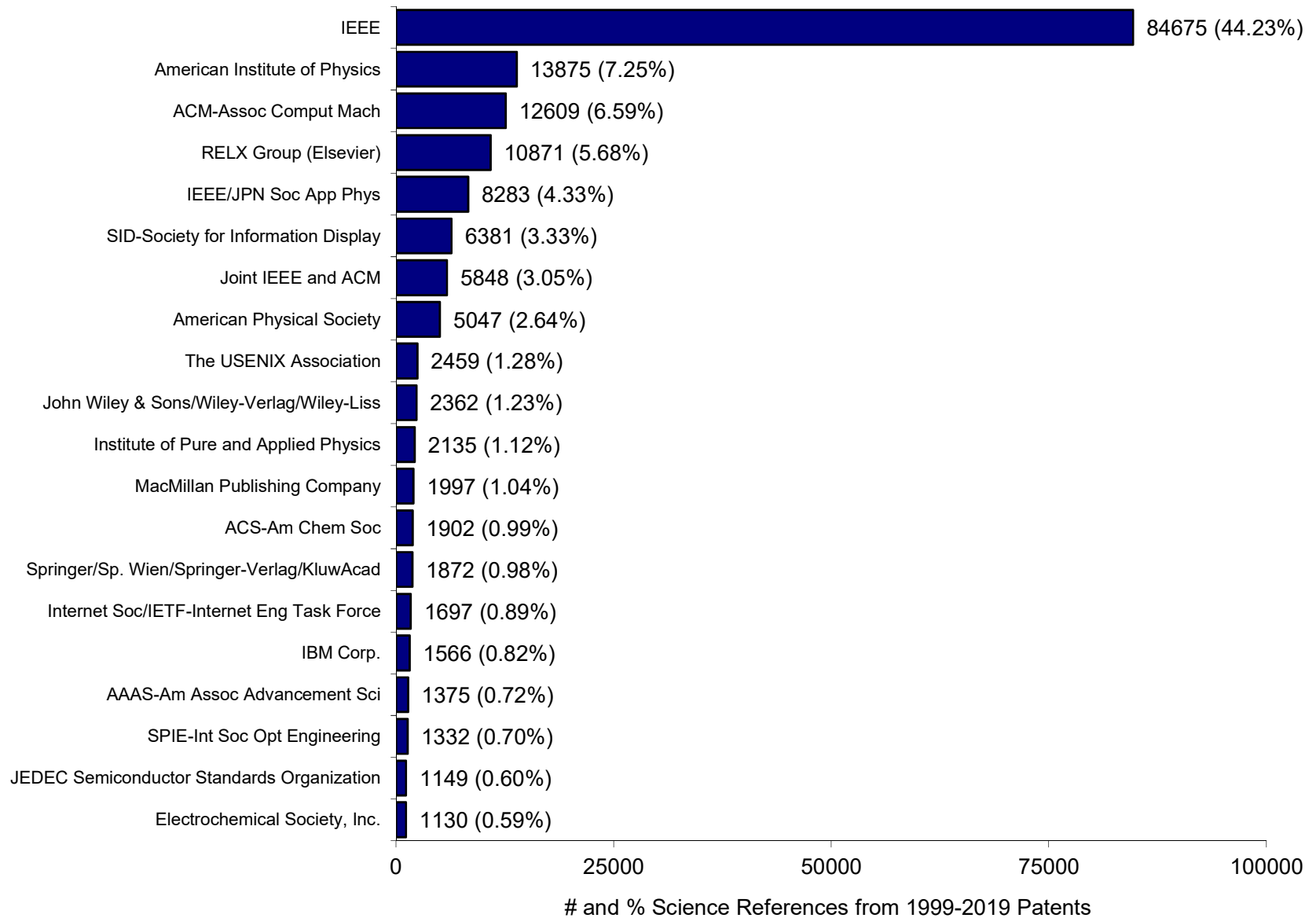
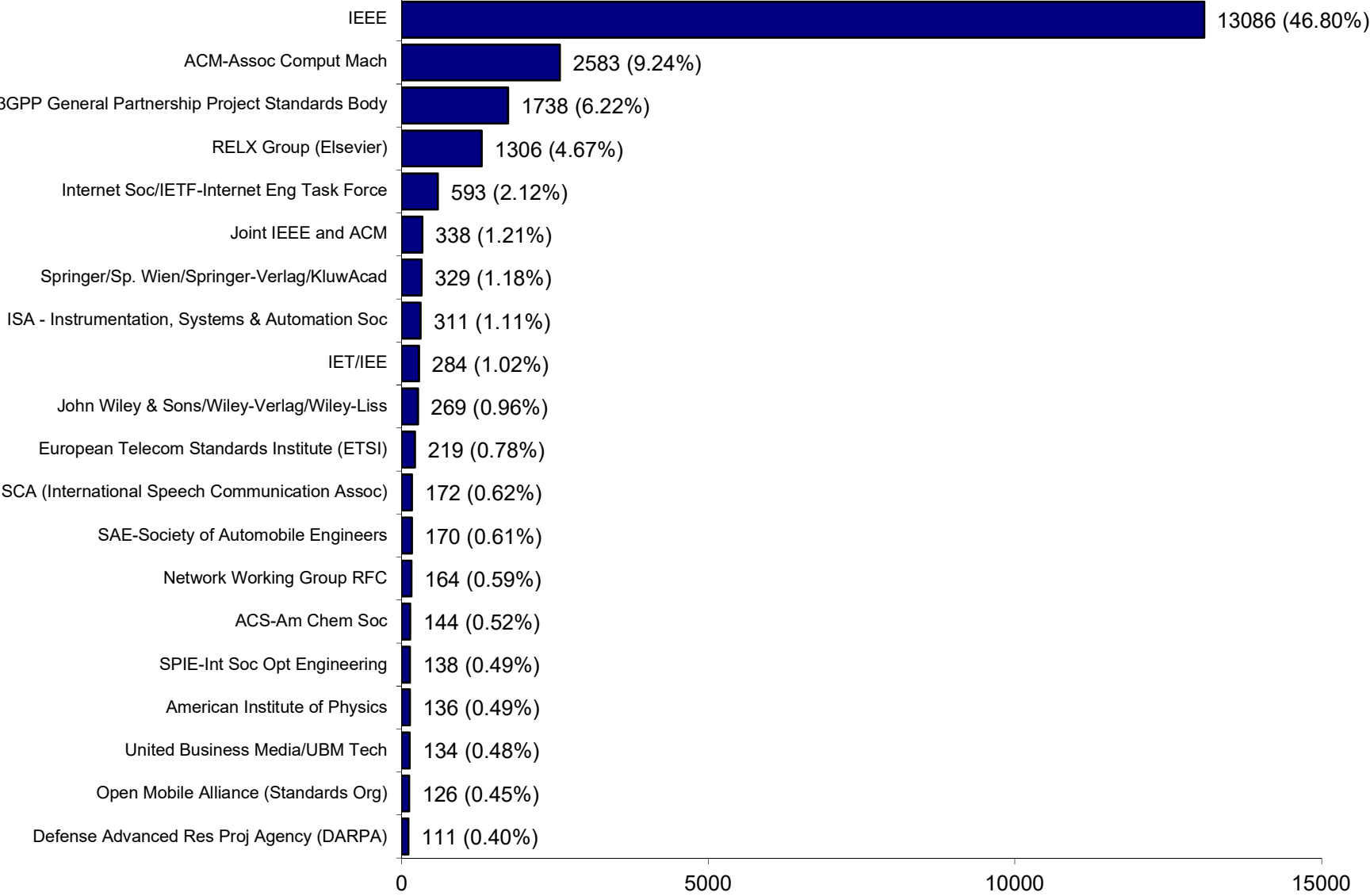


Figure 12 - # and % of Science References from 1999-2019 Internet-Of-Things (IOT) US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 1999-2019 Patents

Figure 13 - # and % of Science References from 1999-2019 Measuring/Testing/Control US Patents to Top 20 Publishers and Conference Organizers

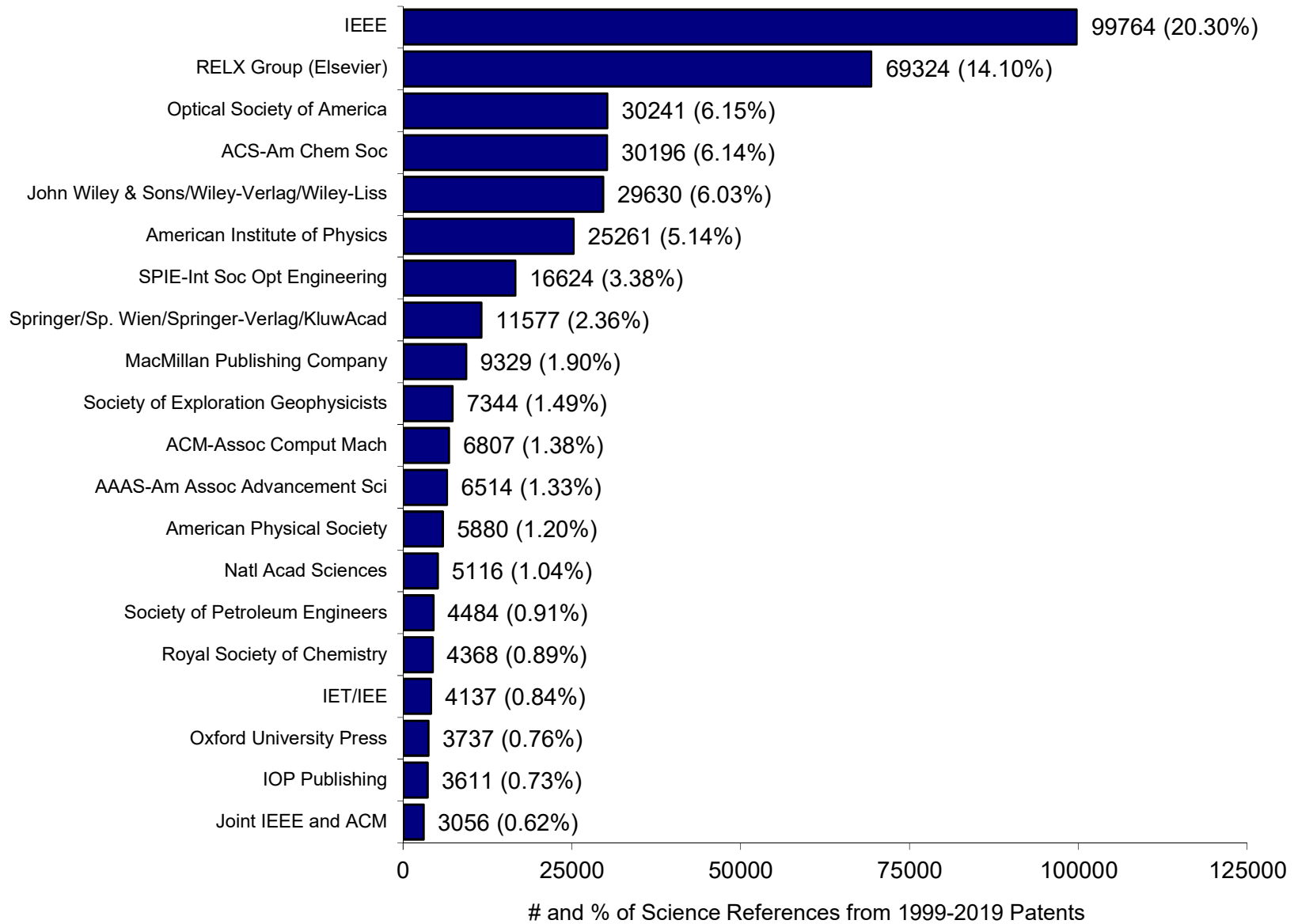


Figure 14 - # and % of Science References from 1999-2019 Optics US Patents to Top 20 Publishers and Conference Organizers

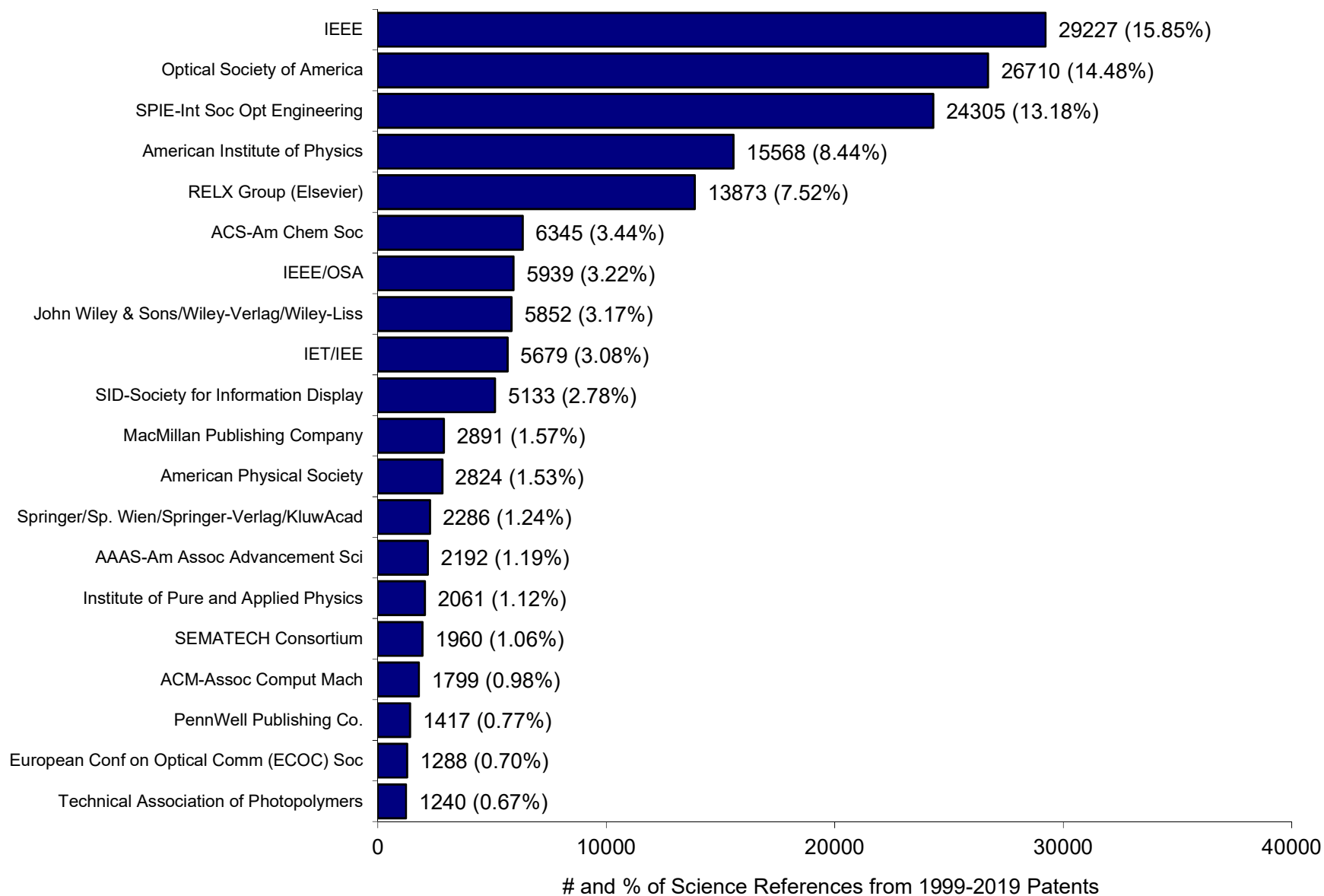


Figure 15 - # and % of Science References from 1999-2019 Power Systems US Patents to Top 20 Publishers and Conference Organizers

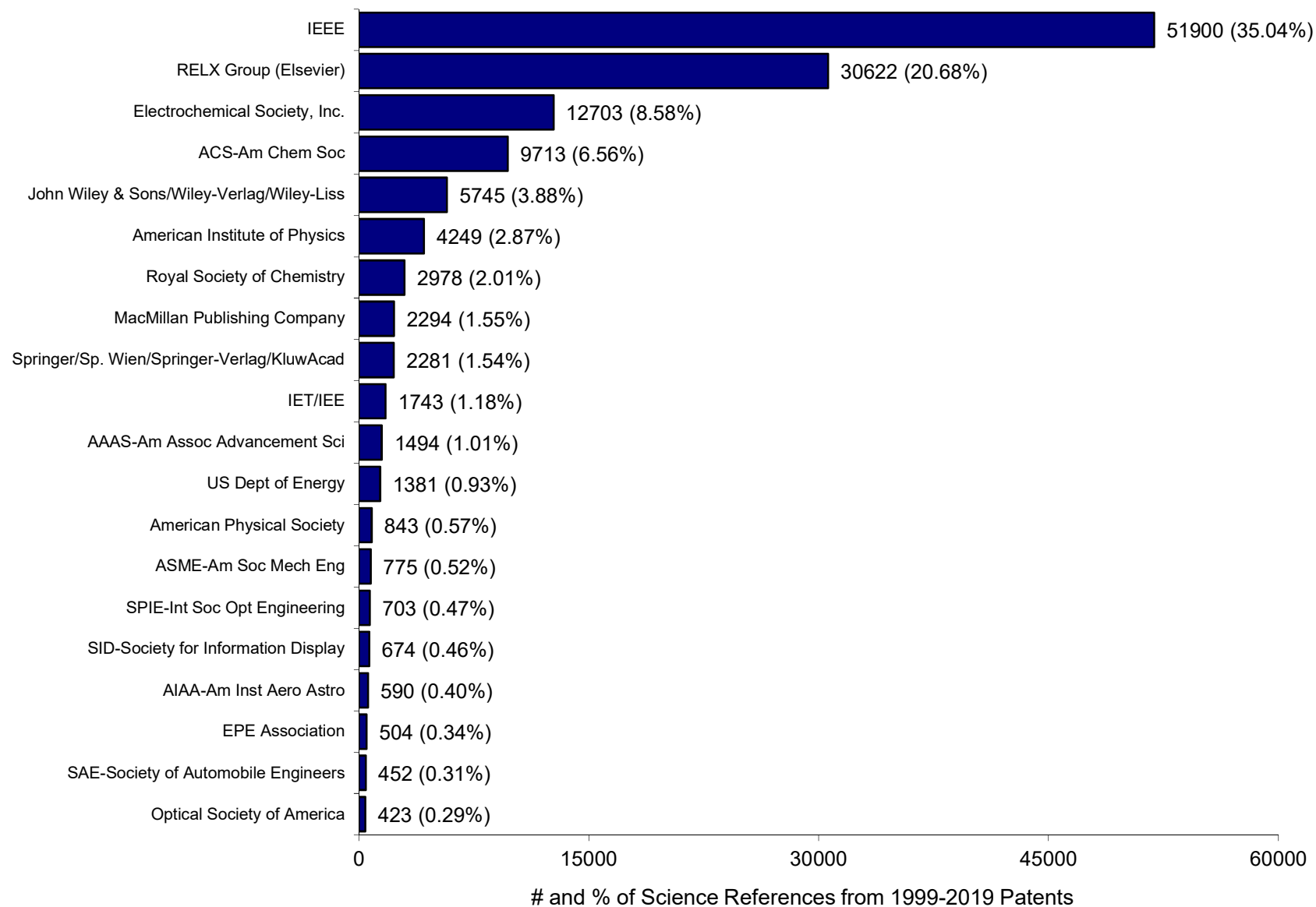


Figure 16 - # and % of Science References from 1999-2019 Robotics and Intelligent Mfg US Patents to Top 20 Publishers and Conference Organizers

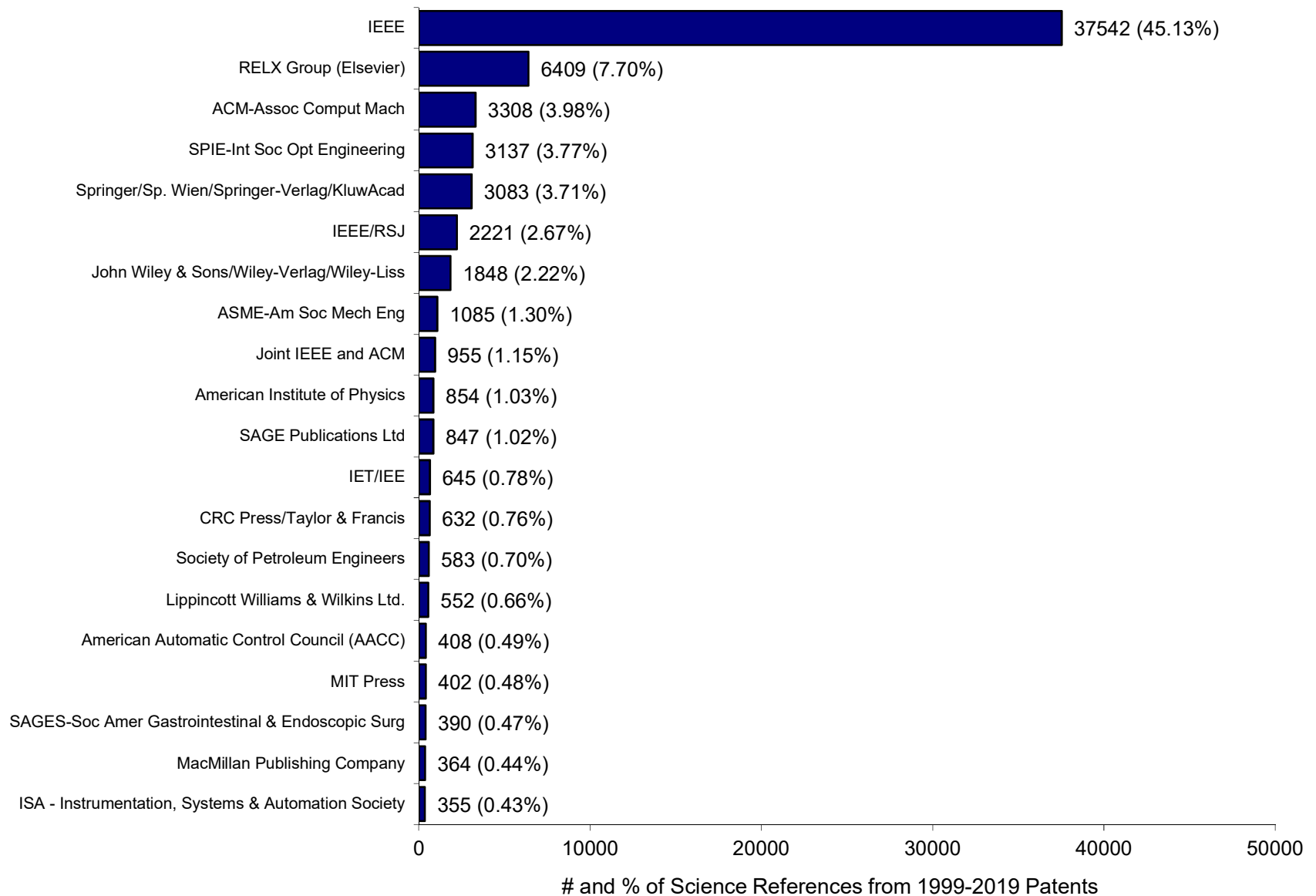


Figure 17 - # and % of Science References from 1999-2019 Semiconductor US Patents to Top 20 Publishers and Conference Organizers

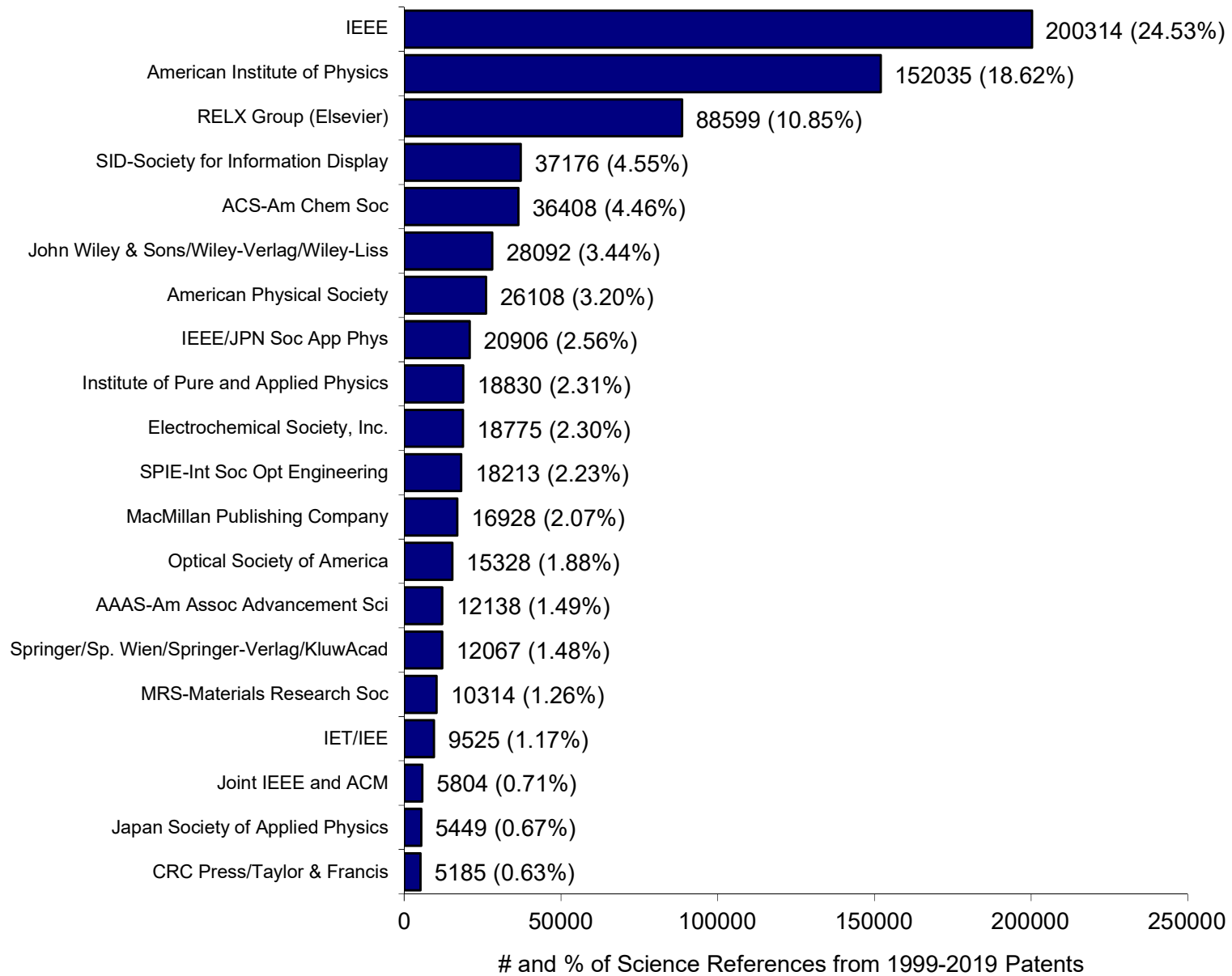


Figure 18 - # and % of Science References from 1999-2019 Smart Meter/Smart Grid US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

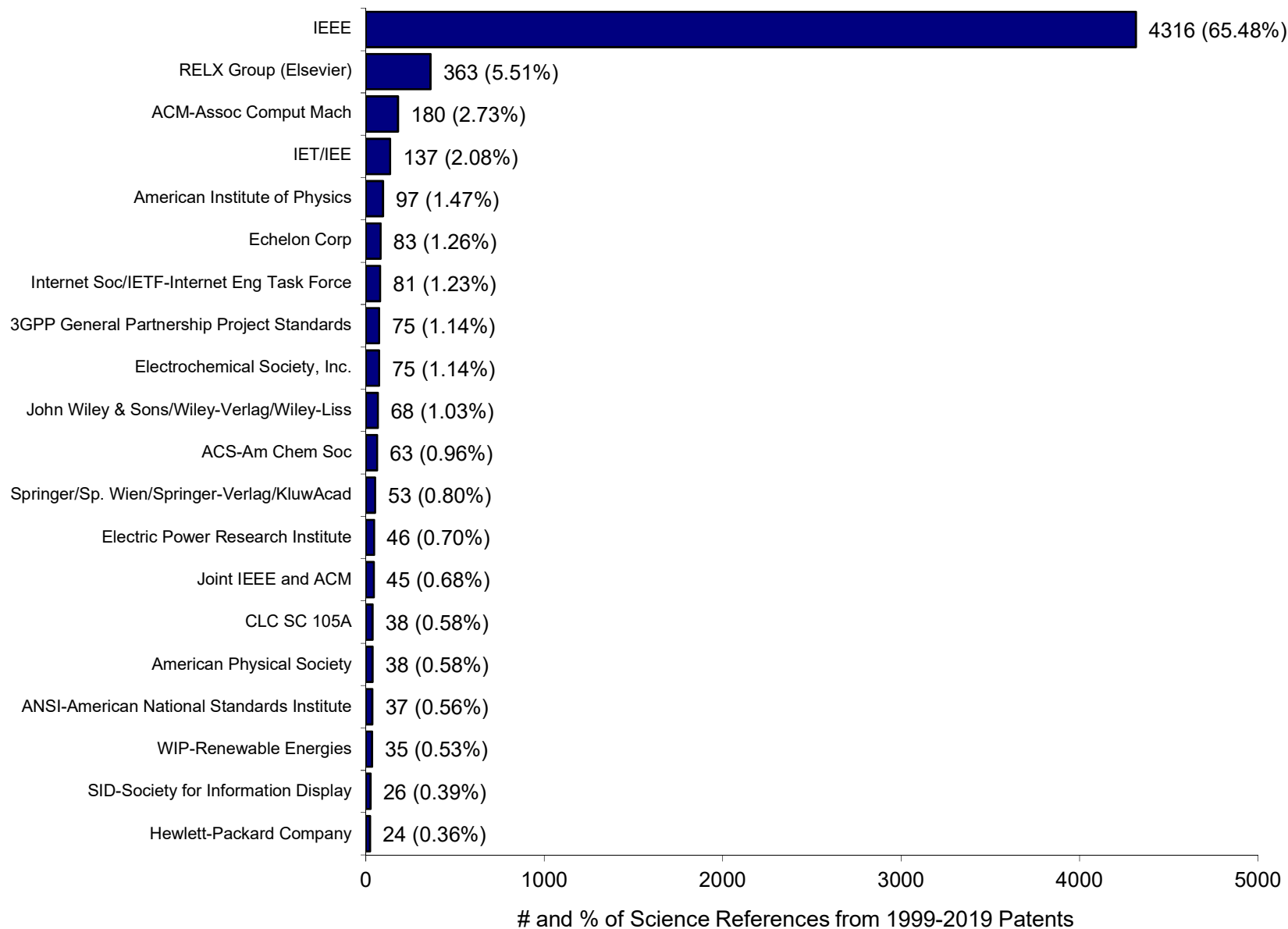


Figure 19 - # and % of Science References from 1999-2019 Solar/Photovoltaic US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

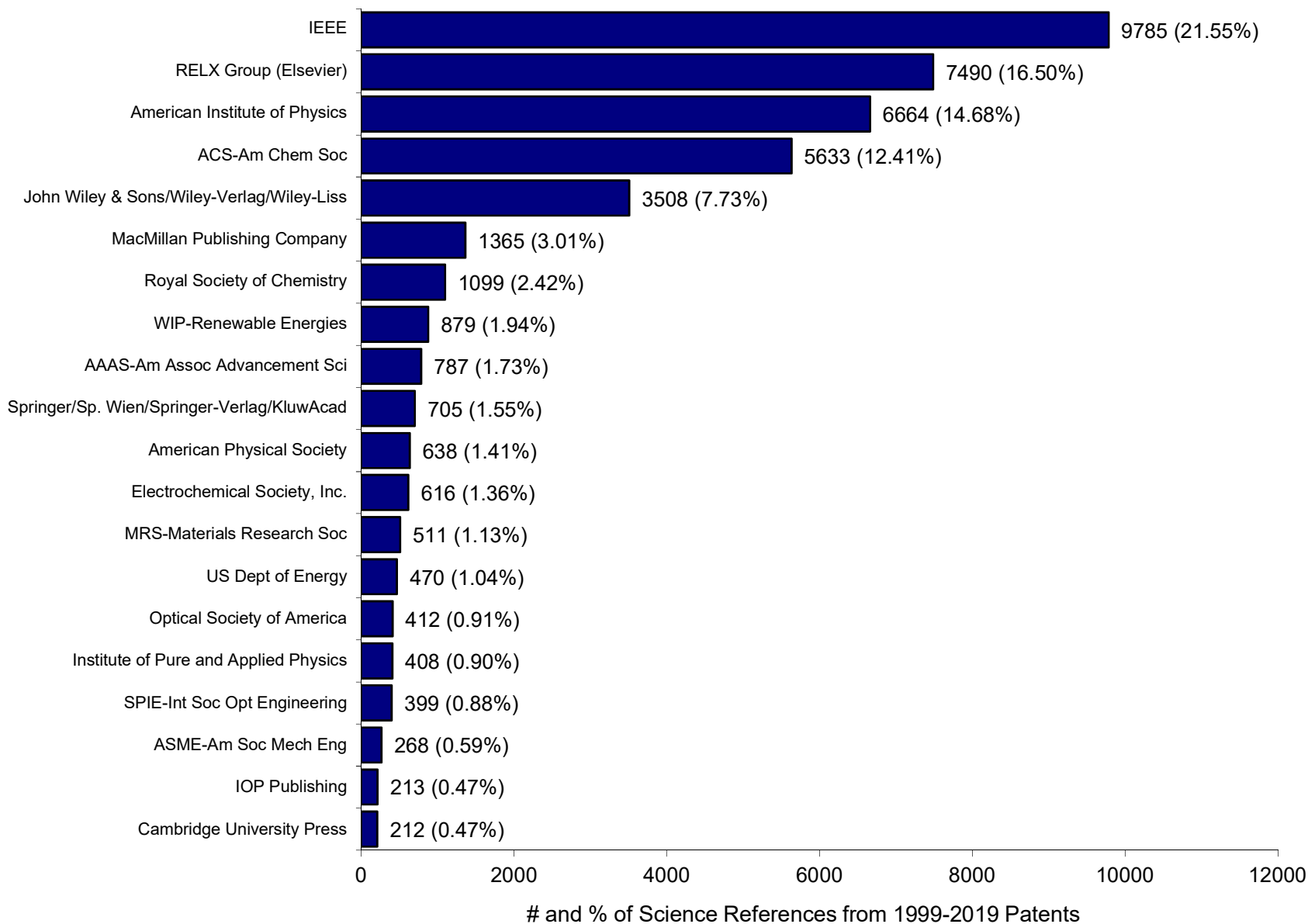


Figure 20 - # and % of Science References from 1999-2019 Telecommunications US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

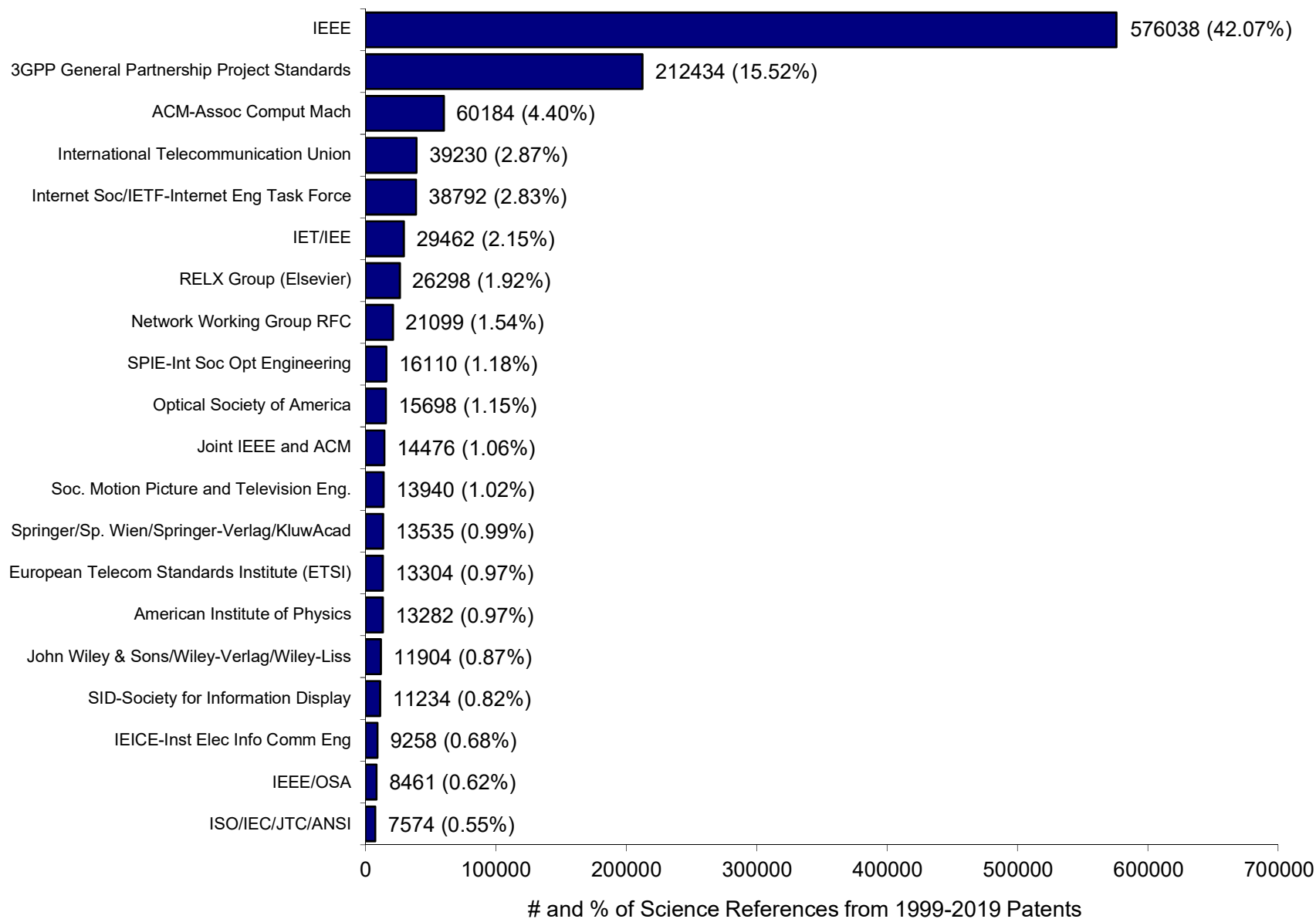


Figure 21 - # and % of Science References from 1999-2019 Virtual/Augmented Reality US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

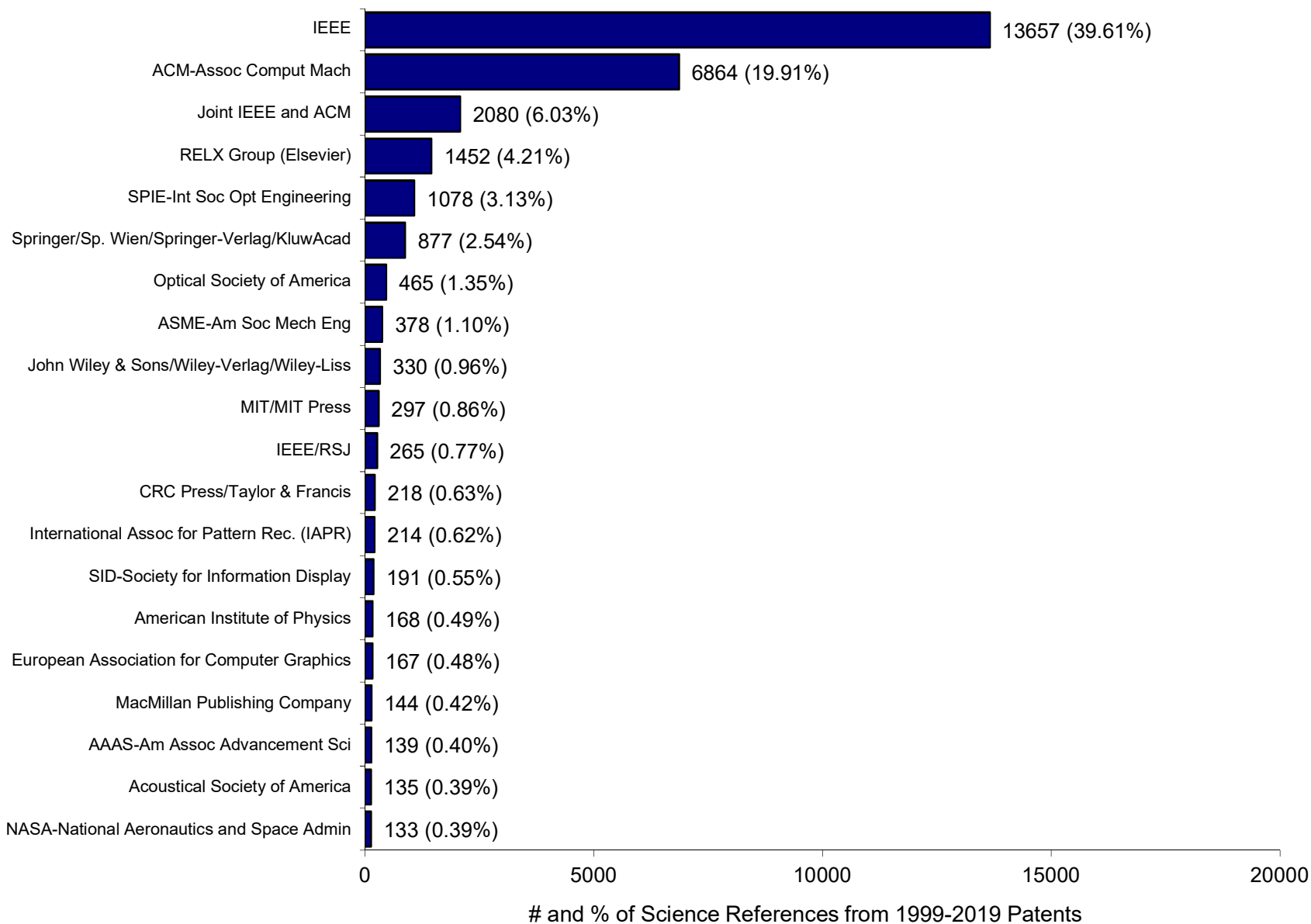


Figure 22 - # and % of Science References from 1999-2019 Wind Energy US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

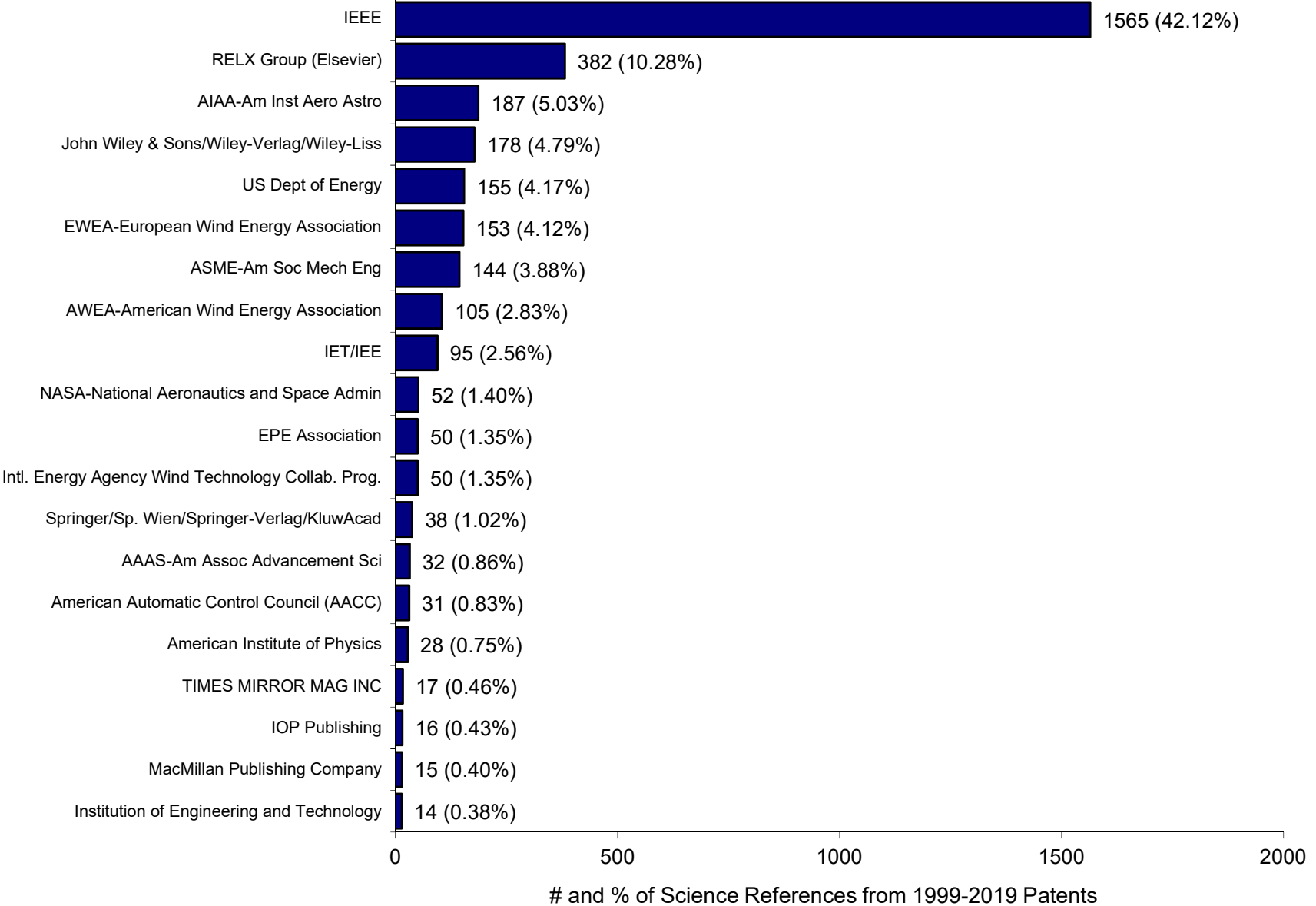
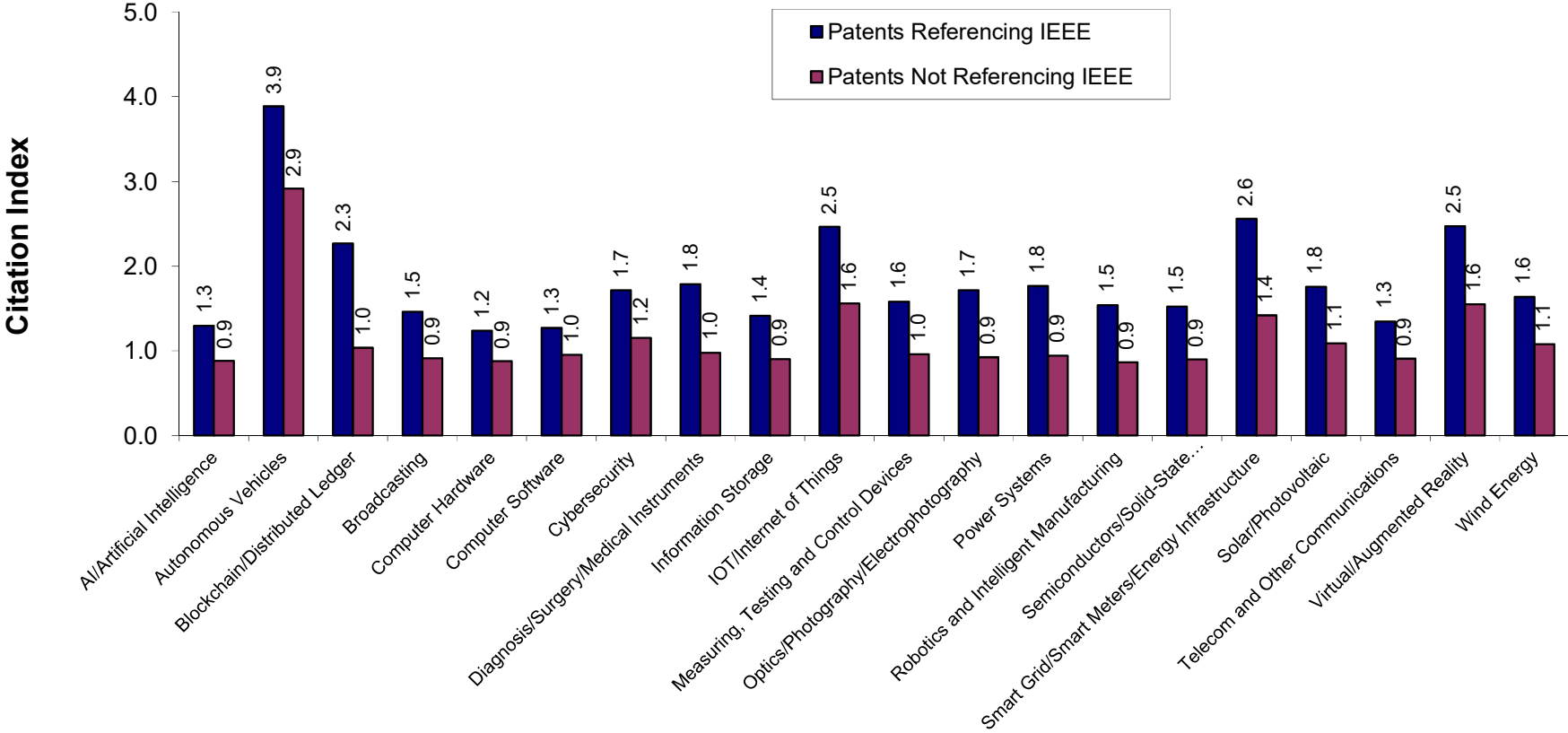


Figure 23 - 1999-2019 Citation Index of US Patents Referencing IEEE Papers and Conferences Versus US Patents not Referencing IEEE for 20 Categories



Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Amazon.com Inc.		
IEEE	4113	28.1
ACM-Assoc Comput Mach	3940	26.9
Internet Soc/IETF-Internet Eng Task Force	761	5.2
RELX Group (Elsevier)	662	4.5
Joint IEEE and ACM	485	3.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	349	2.4
International Data Group	245	1.7
The USENIX Association	255	1.7
Information Processing Society of Japan	239	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	224	1.5
Ziff-Davis	197	1.3
CBS Interactive	184	1.3
Network Working Group RFC	158	1.1
New York Times	147	1.0
197 others with less than 1% each	2692	17.1
Apple Inc		
IEEE	37398	41.5
ACM-Assoc Comput Mach	20075	22.3
RELX Group (Elsevier)	3351	3.7
Joint IEEE and ACM	1618	1.8
ISCA (International Speech Communication Association)	1488	1.7
3GPP General Partnership Project Standards Body	1284	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1261	1.4
357 others with less than 1% each	23591	24.1
AT&T Inc		
IEEE	31748	55.3
ACM-Assoc Comput Mach	4114	7.2
RELX Group (Elsevier)	1657	2.9
IET/IEE	1495	2.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1048	1.8
Internet Soc/IETF-Internet Eng Task Force	980	1.7
IEEE/OSA	785	1.4
Optical Society of America	734	1.3
International Telecommunication Union	720	1.3
3GPP General Partnership Project Standards Body	671	1.2
American Institute of Physics	629	1.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	600	1.0
Joint IEEE and ACM	576	1.0
337 others with less than 1% each	11699	18.3

**Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
BOE Technology Group Ltd		
ACS-Am Chem Soc	65	15.0
RELX Group (Elsevier)	51	11.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	50	11.5
American Institute of Physics	50	11.5
IEEE	45	10.4
SID-Society for Information Display	29	6.7
MacMillan Publishing Company	13	3.0
China Academic Journal Electronic Publishing House	12	2.8
Optical Society of America	12	2.8
Royal Society of Chemistry	11	2.5
Institute of Pure and Applied Physics	10	2.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	9	2.1
CRC Press/Taylor & Francis	8	1.8
American Physical Society	8	1.8
Electrochemical Society, Inc.	6	1.4
Hindawi Publishing Corporation	5	1.2
SPIE-Int Soc Opt Engineering	5	1.2
27 others with less than 1% each	45	10.1
Boeing Co. (The)		
IEEE	3692	26.7
RELX Group (Elsevier)	1956	14.1
AIAA-Am Inst Aero Astro	1204	8.7
American Institute of Physics	520	3.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	504	3.6
SPIE-Int Soc Opt Engineering	491	3.5
ACM-Assoc Comput Mach	344	2.5
NASA-National Aeronautics and Space Admin	305	2.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	300	2.2
ACS-Am Chem Soc	290	2.1
SAE-Society of Automobile Engineers	291	2.1
SAGE Publications Ltd	195	1.4
ASME-Am Soc Mech Eng	178	1.3
Optical Society of America	167	1.2
American Physical Society	165	1.2
McGraw Hill	145	1.0
329 others with less than 1% each	3103	20.1

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Bosch (Robert) GmbH		
IEEE	2556	24.6
RELX Group (Elsevier)	946	9.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	714	6.9
American Diabetes Association	361	3.5
Amer Thoracic Soc	347	3.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	245	2.4
SAE-Society of Automobile Engineers	233	2.2
Electrochemical Society, Inc.	225	2.2
SAGE Publications Ltd	205	2.0
American Medical Informatics Association	193	1.9
Georg Thieme Verlag	186	1.8
ACS-Am Chem Soc	186	1.8
Wichtig Publishing	175	1.7
Ziff-Davis	162	1.6
SPIE-Int Soc Opt Engineering	146	1.4
ACM-Assoc Comput Mach	105	1.0
Assoc Advancement Medical Instrumentation-AAMI	102	1.0
Multidisciplinary Digital Publishing Institute (MDPI)	103	1.0
IET/IEE	103	1.0
247 others with less than 1% each	3087	27.3
Canon Inc		
IEEE	6682	22.0
RELX Group (Elsevier)	3730	12.3
American Institute of Physics	3687	12.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1620	5.3
SPIE-Int Soc Opt Engineering	1575	5.2
ACS-Am Chem Soc	1537	5.1
ACM-Assoc Comput Mach	962	3.2
Optical Society of America	765	2.5
MacMillan Publishing Company	640	2.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	563	1.9
Institute of Pure and Applied Physics	511	1.7
AAAS-Am Assoc Advancement Sci	414	1.4
International Telecommunication Union	359	1.2
American Physical Society	302	1.0
442 others with less than 1% each	6985	19.5

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Cisco Systems Inc.		
IEEE	14392	31.9
Internet Soc/IETF-Internet Eng Task Force	7071	15.7
ACM-Assoc Comput Mach	5210	11.6
Network Working Group RFC	4880	10.8
3GPP General Partnership Project Standards Body	2306	5.1
Joint IEEE and ACM	1033	2.3
European Telecom Standards Institute (ETSI)	940	2.1
International Telecommunication Union	780	1.7
RELX Group (Elsevier)	721	1.6
263 others with less than 1% each	7723	15.0
Dell Technologies Inc		
ACM-Assoc Comput Mach	5797	37.1
IEEE	3978	25.5
The USENIX Association	1173	7.5
Internet Soc/IETF-Internet Eng Task Force	836	5.4
Joint IEEE and ACM	627	4.0
RELX Group (Elsevier)	300	1.9
Springer/Sp. Wien/Springer-Verlag/KluwAcad	213	1.4
International Association for Cryptologic Research (IACR)	165	1.1
217 others with less than 1% each	2531	14.2
Denso Corp		
IEEE	672	39.9
RELX Group (Elsevier)	172	10.2
American Institute of Physics	99	5.9
SAE-Society of Automobile Engineers	69	4.1
IET/IEE	58	3.4
Institute of Pure and Applied Physics	39	2.3
ACM-Assoc Comput Mach	37	2.2
IEICE-Inst Elec Info Comm Eng	36	2.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	36	2.1
ACS-Am Chem Soc	29	1.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	25	1.5
Electrochemical Society, Inc.	20	1.2
Trans Tech Publications Ltd.	19	1.1
Joint IEEE and ACM	16	1.0
123 others with less than 1% each	357	23.8

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Ericsson		
3GPP General Partnership Project Standards Body	17788	37.7
IEEE	14439	30.6
Network Working Group RFC	3490	7.4
Internet Soc/IETF-Internet Eng Task Force	2636	5.6
ACM-Assoc Comput Mach	955	2.0
Optical Society of America	905	1.9
European Telecom Standards Institute (ETSI)	870	1.8
International Telecommunication Union	778	1.6
IET/IEE	604	1.3
267 others with less than 1% each	4744	8.1
Facebook Inc		
IEEE	1710	29.6
ACM-Assoc Comput Mach	1628	28.2
RELX Group (Elsevier)	240	4.2
DOW JONES & CO, INC	197	3.4
Internet Soc/IETF-Internet Eng Task Force	149	2.6
Joint IEEE and ACM	138	2.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	118	2.0
Condé Nast	107	1.9
CBS Interactive	106	1.8
New York Times	88	1.5
C M P Media	81	1.4
Ziff-Davis	69	1.2
FUJITSU LTD	65	1.1
Gannett Co.	60	1.0
106 others with less than 1% each	1019	17.2
Ford Motor Co.		
SAE-Society of Automobile Engineers	2339	31.9
IEEE	1669	22.8
RELX Group (Elsevier)	810	11.0
IP.Com	344	4.7
American Automatic Control Council (AACC)	187	2.5
ACS-Am Chem Soc	154	2.1
ACM-Assoc Comput Mach	140	1.9
IEEE/RSJ	105	1.4
Society of Automotive Engineers of Japan, Inc. (JSAE)	93	1.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	85	1.2
ASME-Am Soc Mech Eng	89	1.2
IET/IEE	73	1.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	74	1.0
177 others with less than 1% each	1172	14.5

**Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Fuji Film Holdings Corp		
IEEE	2059	13.9
RELX Group (Elsevier)	1839	12.4
ACM-Assoc Comput Mach	1362	9.2
ACS-Am Chem Soc	1123	7.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	890	6.0
SPIE-Int Soc Opt Engineering	696	4.7
American Institute of Physics	672	4.5
MacMillan Publishing Company	625	4.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	362	2.4
AAAS-Am Assoc Advancement Sci	250	1.7
Optical Society of America	238	1.6
Cell Press	218	1.5
Natl Acad Sciences	201	1.4
Oxford University Press	158	1.1
Institute of Pure and Applied Physics	152	1.0
IEICE-Inst Elec Info Comm Eng	147	1.0
414 others with less than 1% each	3796	21.4
Fujitsu Limited		
IEEE	8933	36.1
3GPP General Partnership Project Standards Body	2904	11.7
ACM-Assoc Comput Mach	1132	4.6
Optical Society of America	1081	4.4
Joint IEEE and ACM	1072	4.3
IEICE-Inst Elec Info Comm Eng	1012	4.1
RELX Group (Elsevier)	819	3.3
American Institute of Physics	640	2.6
IET/IEE	586	2.4
IEEE/OSA	580	2.3
European Conference on Optical Communication (ECOC) Society	496	2.0
International Telecommunication Union	401	1.6
Internet Soc/IETF-Internet Eng Task Force	398	1.6
ATM Forum Standards Body	309	1.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	285	1.2
348 others with less than 1% each	4074	13.3

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
General Electric Company		
US Dept of Energy	10600	16.8
IEEE	9079	14.4
RELX Group (Elsevier)	8544	13.5
Society of Petroleum Engineers	4489	7.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4195	6.6
General Electric Co.	3428	5.4
ACS-Am Chem Soc	2696	4.3
American Institute of Physics	1634	2.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1466	2.3
SPIE-Int Soc Opt Engineering	737	1.2
MacMillan Publishing Company	688	1.1
ASME-Am Soc Mech Eng	687	1.1
Lippincott Williams & Wilkins Ltd.	666	1.1
American Physical Society	603	1.0
735 others with less than 1% each	13681	17.5
General Motors Corp		
IEEE	1535	22.0
RELX Group (Elsevier)	1394	19.9
SAE-Society of Automobile Engineers	851	12.2
ACS-Am Chem Soc	496	7.1
Electrochemical Society, Inc.	428	6.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	286	4.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	184	2.6
Royal Society of Chemistry	154	2.2
ASME-Am Soc Mech Eng	142	2.0
American Institute of Physics	119	1.7
Optical Society of America	99	1.4
MacMillan Publishing Company	80	1.1
American Automatic Control Council (AACC)	67	1.0
182 others with less than 1% each	1153	14.6
Google Inc.		
IEEE	19425	35.3
ACM-Assoc Comput Mach	12545	22.8
RELX Group (Elsevier)	2324	4.2
SPIE-Int Soc Opt Engineering	1458	2.7
International Telecommunication Union	1406	2.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1388	2.5
3GPP General Partnership Project Standards Body	1059	1.9
Joint IEEE and ACM	956	1.7
World Wide Web Consortium	955	1.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	846	1.5
ACL - Association for Computational Linguistics	727	1.3
Internet Soc/IETF-Internet Eng Task Force	538	1.0
378 others with less than 1% each	11367	19.4

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Halliburton Co. (Holding)		
Society of Petroleum Engineers	9602	47.2
RELX Group (Elsevier)	1700	8.4
ACS-Am Chem Soc	1674	8.2
SPWLA-Society of Petrophysicists and Well Log Analysts	797	3.9
IEEE	743	3.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	540	2.7
Society of Exploration Geophysicists	529	2.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	481	2.4
PennWell Publishing Co.	287	1.4
American Institute of Mining and Metallurgical Engineers	271	1.3
SPIE-Int Soc Opt Engineering	251	1.2
213 others with less than 1% each	3450	14.5
Hitachi Ltd		
IEEE	5523	24.6
RELX Group (Elsevier)	1686	7.5
ACM-Assoc Comput Mach	1471	6.5
American Institute of Physics	1367	6.1
IEICE-Inst Elec Info Comm Eng	776	3.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	715	3.2
Internet Soc/IETF-Internet Eng Task Force	590	2.6
ACS-Am Chem Soc	551	2.5
The USENIX Association	416	1.9
Institute of Pure and Applied Physics	391	1.7
International Telecommunication Union	352	1.6
Network Working Group RFC	344	1.5
SPIE-Int Soc Opt Engineering	304	1.4
MacMillan Publishing Company	313	1.4
Nikkei Business Publications, Inc.	312	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	296	1.3
SID-Society for Information Display	269	1.2
IET/IEE	244	1.1
3GPP General Partnership Project Standards Body	251	1.1
Joint IEEE and ACM	249	1.1
IEEE/JPN Soc App Phys	238	1.1
IBM Corp.	235	1.0
American Physical Society	230	1.0
Optical Society of America	226	1.0
459 others with less than 1% each	5126	18.5

**Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Hon Hai Precision Industry Co. Ltd.(also known as Foxconn)		
3GPP General Partnership Project Standards Body	5802	24.1
IEEE	4605	19.2
American Institute of Physics	1533	6.4
SID-Society for Information Display	1409	5.9
RELX Group (Elsevier)	1138	4.7
ACM-Assoc Comput Mach	1046	4.4
ACS-Am Chem Soc	844	3.5
International Telecommunication Union	737	3.1
ISO/IEC/JTC	521	2.2
SPIE-Int Soc Opt Engineering	524	2.2
AAAS-Am Assoc Advancement Sci	481	2.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	483	2.0
MacMillan Publishing Company	372	1.5
Institute of Pure and Applied Physics	341	1.4
American Physical Society	309	1.3
IEICE-Inst Elec Info Comm Eng	290	1.2
Internet Soc/IETF-Internet Eng Task Force	284	1.2
276 others with less than 1% each	3312	11.1

Honda Motor Co. Ltd.(Honda Giken Kogyo KK)

IEEE	2334	38.6
RELX Group (Elsevier)	922	15.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	316	5.2
ACS-Am Chem Soc	189	3.1
IEEE/RSJ	185	3.1
ACM-Assoc Comput Mach	178	2.9
ASME-Am Soc Mech Eng	138	2.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	138	2.3
MacMillan Publishing Company	77	1.3
AAAS-Am Assoc Advancement Sci	75	1.2
Electrochemical Society, Inc.	65	1.1
American Institute of Physics	61	1.0
230 others with less than 1% each	1362	19.2

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Honeywell International Inc.</i>		
IEEE	8505	31.0
RELX Group (Elsevier)	4134	15.1
ACS-Am Chem Soc	2034	7.4
SPIE-Int Soc Opt Engineering	1341	4.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	995	3.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	845	3.1
American Institute of Physics	752	2.7
Optical Society of America	505	1.8
ACM-Assoc Comput Mach	436	1.6
Royal Society of Chemistry	369	1.3
SAE-Society of Automobile Engineers	328	1.2
IET/IEEE	275	1.0
439 others with less than 1% each	6918	21.7
<i>HP Inc</i>		
IEEE	8501	30.8
ACM-Assoc Comput Mach	4029	14.6
RELX Group (Elsevier)	1251	4.5
Joint IEEE and ACM	1172	4.2
Internet Soc/IETF-Internet Eng Task Force	1075	3.9
American Institute of Physics	969	3.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	624	2.3
SPIE-Int Soc Opt Engineering	645	2.3
The USENIX Association	545	2.0
ACS-Am Chem Soc	521	1.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	390	1.4
Optical Society of America	309	1.1
AAAS-Am Assoc Advancement Sci	303	1.1
American Physical Society	312	1.1
Network Working Group RFC	269	1.0
406 others with less than 1% each	6717	21.7
<i>Huawei Technologies Company Ltd. (owned by HUAWEI Investme</i>		
3GPP General Partnership Project Standards Body	13931	40.4
IEEE	9563	27.7
International Telecommunication Union	2542	7.4
Internet Soc/IETF-Internet Eng Task Force	2297	6.7
Network Working Group RFC	1501	4.4
ACM-Assoc Comput Mach	635	1.8
European Telecom Standards Institute (ETSI)	450	1.3
Open Mobile Alliance (Standards Org)	395	1.1
203 others with less than 1% each	3158	7.3

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Hyundai Motor Co.		
RELX Group (Elsevier)	166	30.0
IEEE	148	26.7
ACS-Am Chem Soc	47	8.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	26	4.7
SAE-Society of Automobile Engineers	26	4.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	18	3.2
ACM-Assoc Comput Mach	16	2.9
Royal Society of Chemistry	12	2.2
American Automatic Control Council (AACC)	11	2.0
American Institute of Physics	11	2.0
Electrochemical Society, Inc.	10	1.8
IET/IEE	6	1.1
39 others with less than 1% each	57	10.8
Intel Corporation		
IEEE	33887	46.9
3GPP General Partnership Project Standards Body	7480	10.3
ACM-Assoc Comput Mach	5429	7.5
Joint IEEE and ACM	4698	6.5
RELX Group (Elsevier)	1882	2.6
American Institute of Physics	1593	2.2
IET/IEE	1113	1.5
IEEE/JPN Soc App Phys	807	1.1
Internet Soc/IETF-Internet Eng Task Force	768	1.1
430 others with less than 1% each	14662	17.9
International Business Machines Corp		
IEEE	60011	32.9
ACM-Assoc Comput Mach	32286	17.7
Joint IEEE and ACM	9933	5.5
RELX Group (Elsevier)	7869	4.3
IP.Com	6125	3.4
Internet Soc/IETF-Internet Eng Task Force	5743	3.2
American Institute of Physics	5286	2.9
IBM Corp.	4041	2.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	3212	1.8
ACS-Am Chem Soc	3066	1.7
The USENIX Association	2768	1.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2508	1.4
SPIE-Int Soc Opt Engineering	2114	1.2
National Institute of Standards and Technology (NIST)	2022	1.1
Very Large Data Base Endowment Inc. (VLDB Endowment)	1839	1.0
807 others with less than 1% each	33405	14.4

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Johnson & Johnson		
RELX Group (Elsevier)	41403	23.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	18273	10.4
ACS-Am Chem Soc	11014	6.3
MacMillan Publishing Company	8897	5.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	7434	4.2
Lippincott Williams & Wilkins Ltd.	7411	4.2
Natl Acad Sciences	4708	2.7
IEEE	3291	1.9
American SociETY for Microbiology	2896	1.6
AAAS-Am Assoc Advancement Sci	2630	1.5
Oxford University Press	2569	1.5
Cell Press	2363	1.3
American Society for Pharmacology and Experimental Therapeutics	2257	1.3
Am Soc Biochemistry Molec Biology	2138	1.2
Mosby Inc.	1750	1.0
American Association of Immunologists	1703	1.0
Mary Ann Liebert Inc.	1808	1.0
730 others with less than 1% each	53610	25.8
Koninklijke Philips N.V.		
IEEE	7978	27.6
RELX Group (Elsevier)	2976	10.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2404	8.3
Lippincott Williams & Wilkins Ltd.	1614	5.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1420	4.9
SPIE-Int Soc Opt Engineering	1237	4.3
American Institute of Physics	940	3.3
ACM-Assoc Comput Mach	597	2.1
Society of Magnetic Resonance in Medicine (SMRM)	588	2.0
Optical Society of America	512	1.8
American Medical Informatics Association	309	1.1
3GPP General Partnership Project Standards Body	307	1.1
SAGE Publications Ltd	300	1.0
521 others with less than 1% each	7720	22.8

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Kyocera Corp.		
3GPP General Partnership Project Standards Body	1545	39.0
IEEE	1216	30.7
RELX Group (Elsevier)	212	5.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	116	2.9
Electrochemical Society, Inc.	111	2.8
American Institute of Physics	61	1.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	57	1.4
ACS-Am Chem Soc	52	1.3
IET/IEE	53	1.3
ACM-Assoc Comput Mach	42	1.1
IEICE-Inst Elec Info Comm Eng	41	1.0
108 others with less than 1% each	455	11.2
LG Electronics Inc.		
3GPP General Partnership Project Standards Body	23847	54.4
IEEE	9081	20.7
ISO/IEC/JTC/ANSI	1563	3.6
International Telecommunication Union	1308	3.0
ATSC Std	1180	2.7
European Telecom Standards Institute (ETSI)	1109	2.5
Audio Eng Soc	817	1.9
ISO-International Standards Organization	455	1.0
169 others with less than 1% each	4491	9.6
Medtronic Inc		
RELX Group (Elsevier)	25526	17.5
Lippincott Williams & Wilkins Ltd.	17022	11.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	12909	8.8
IEEE	11997	8.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	10545	7.2
American Physiological Society	3653	2.5
American Association of Neurological Surgeons	3289	2.3
Oxford University Press	3200	2.2
ACS-Am Chem Soc	2659	1.8
Radiological Society of North America	2475	1.7
Mosby Inc.	2195	1.5
SPIE-Int Soc Opt Engineering	1893	1.3
Wolters Kluwer	1861	1.3
International Federation of Gynecology and Obstetrics (FIGO)	1709	1.2
S. Karger AG	1536	1.1
569 others with less than 1% each	43590	26.8

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Micron Technology Inc.</i>		
IEEE	45864	34.0
RELX Group (Elsevier)	21538	16.0
American Institute of Physics	16045	11.9
IEEE/JPN Soc App Phys	5893	4.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5264	3.9
ACS-Am Chem Soc	3588	2.7
Electrochemical Society, Inc.	3460	2.6
Institute of Pure and Applied Physics	3043	2.3
American Physical Society	2821	2.1
MRS-Materials Research Soc	2115	1.6
SPIE-Int Soc Opt Engineering	2124	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1667	1.2
CRC Press/Taylor & Francis	1401	1.0
269 others with less than 1% each	20202	13.9
<i>Microsoft Corporation</i>		
IEEE	66065	34.4
ACM-Assoc Comput Mach	54166	28.2
Joint IEEE and ACM	6007	3.1
RELX Group (Elsevier)	6023	3.1
The USENIX Association	4047	2.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	4129	2.1
Internet Soc/IETF-Internet Eng Task Force	3045	1.6
International Telecommunication Union	2723	1.4
SPIE-Int Soc Opt Engineering	2360	1.2
625 others with less than 1% each	43719	19.1
<i>Mitsubishi Electric Corp</i>		
IEEE	5848	44.9
3GPP General Partnership Project Standards Body	1309	10.0
ACM-Assoc Comput Mach	876	6.7
IEICE-Inst Elec Info Comm Eng	463	3.6
RELX Group (Elsevier)	427	3.3
IET/IEE	331	2.5
American Institute of Physics	308	2.4
International Telecommunication Union	251	1.9
SPIE-Int Soc Opt Engineering	205	1.6
International Association for Cryptologic Research (IACR)	211	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	194	1.5
IEEE/JPN Soc App Phys	176	1.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	129	1.0
Optical Society of America	135	1.0
251 others with less than 1% each	2162	14.3

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
NEC Corp		
IEEE	8017	33.1
3GPP General Partnership Project Standards Body	5083	21.0
ACM-Assoc Comput Mach	1214	5.0
IEICE-Inst Elec Info Comm Eng	1015	4.2
American Institute of Physics	788	3.3
RELX Group (Elsevier)	759	3.1
Joint IEEE and ACM	603	2.5
Optical Society of America	457	1.9
IET/IEE	364	1.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	363	1.5
Internet Soc/IETF-Internet Eng Task Force	314	1.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	237	1.0
SPIE-Int Soc Opt Engineering	234	1.0
IEEE/OSA	247	1.0
347 others with less than 1% each	4542	15.0
Panasonic Corporation		
IEEE	10519	31.8
3GPP General Partnership Project Standards Body	4999	15.1
RELX Group (Elsevier)	2001	6.1
IEICE-Inst Elec Info Comm Eng	1586	4.8
International Telecommunication Union	1558	4.7
American Institute of Physics	1321	4.0
Institute of Pure and Applied Physics	938	2.8
Internet Soc/IETF-Internet Eng Task Force	595	1.8
ACM-Assoc Comput Mach	510	1.5
Electrochemical Society, Inc.	483	1.5
ACS-Am Chem Soc	469	1.4
SPIE-Int Soc Opt Engineering	425	1.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	390	1.2
IET/IEE	375	1.1
ISO/IEC/JTC/ANSI	359	1.1
394 others with less than 1% each	6543	17.4

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Qualcomm Inc		
IEEE	40139	42.5
3GPP General Partnership Project Standards Body	17904	18.9
International Telecommunication Union	7643	8.1
ISO/IEC/JTC/ANSI	2610	2.8
ACM-Assoc Comput Mach	1888	2.0
RELX Group (Elsevier)	1763	1.9
Internet Soc/IETF-Internet Eng Task Force	1788	1.9
SID-Society for Information Display	1808	1.9
SPIE-Int Soc Opt Engineering	1345	1.4
European Telecom Standards Institute (ETSI)	1103	1.2
IET/IEE	1081	1.1
American Institute of Physics	1038	1.1
ISO/IEC/JTC	978	1.0
Network Working Group RFC	924	1.0
361 others with less than 1% each	12506	11.0
Ricoh Co. Ltd.		
IEEE	5685	44.7
ACM-Assoc Comput Mach	1879	14.8
SPIE-Int Soc Opt Engineering	874	6.9
RELX Group (Elsevier)	678	5.3
International Association for Pattern Recognition (IAPR)	529	4.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	344	2.7
American Institute of Physics	238	1.9
IEICE-Inst Elec Info Comm Eng	141	1.1
ISO-International Standards Organization	144	1.1
187 others with less than 1% each	2216	15.5
Samsung Electronics Co Ltd		
IEEE	15928	28.7
3GPP General Partnership Project Standards Body	11850	21.3
RELX Group (Elsevier)	3030	5.5
ACS-Am Chem Soc	2590	4.7
American Institute of Physics	2391	4.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1753	3.2
ACM-Assoc Comput Mach	1527	2.7
International Telecommunication Union	1420	2.6
SID-Society for Information Display	985	1.8
MacMillan Publishing Company	822	1.5
SPIE-Int Soc Opt Engineering	748	1.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	625	1.1
Audio Eng Soc	609	1.1
European Telecom Standards Institute (ETSI)	567	1.0
Joint IEEE and ACM	530	1.0
516 others with less than 1% each	10163	15.1

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Samsung SDI Co Ltd		
American Institute of Physics	1811	20.9
RELX Group (Elsevier)	1783	20.5
ACS-Am Chem Soc	1147	13.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	768	8.8
SID-Society for Information Display	489	5.6
IEEE	355	4.1
Royal Society of Chemistry	244	2.8
Electrochemical Society, Inc.	214	2.5
MacMillan Publishing Company	179	2.1
Institute of Pure and Applied Physics	166	1.9
IEC-International Electrotechnical Commission	152	1.8
American Physical Society	136	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	134	1.5
J. Van Voorst	109	1.3
137 others with less than 1% each	994	9.5
Seiko Epson Corporation		
IEEE	2998	33.5
Joint IEEE and ACM	704	7.9
ACM-Assoc Comput Mach	682	7.6
RELX Group (Elsevier)	642	7.2
American Institute of Physics	617	6.9
SID-Society for Information Display	460	5.1
ACS-Am Chem Soc	276	3.1
IEEE/JPN Soc App Phys	181	2.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	160	1.8
Institute of Pure and Applied Physics	160	1.8
IBM Corp.	149	1.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	141	1.6
SPIE-Int Soc Opt Engineering	123	1.4
IEICE-Inst Elec Info Comm Eng	100	1.1
American Physical Society	98	1.1
Optical Society of America	90	1.0
196 others with less than 1% each	1357	13.0

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Siemens Aktiengesellschaft		
IEEE	13427	35.8
RELX Group (Elsevier)	3975	10.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3029	8.1
SPIE-Int Soc Opt Engineering	1586	4.2
Joint IEEE and ACM	1206	3.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	922	2.5
ACM-Assoc Comput Mach	893	2.4
American Institute of Physics	827	2.2
ACS-Am Chem Soc	490	1.3
Society of Magnetic Resonance in Medicine (SMRM)	481	1.3
Radiological Society of North America	412	1.1
Lippincott Williams & Wilkins Ltd.	380	1.0
619 others with less than 1% each	9863	22.5
Sony Corp		
IEEE	13104	41.2
ACM-Assoc Comput Mach	2576	8.1
3GPP General Partnership Project Standards Body	2000	6.3
RELX Group (Elsevier)	1433	4.5
International Telecommunication Union	1395	4.4
SPIE-Int Soc Opt Engineering	781	2.5
American Institute of Physics	619	1.9
European Telecom Standards Institute (ETSI)	503	1.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	468	1.5
Internet Soc/IETF-Internet Eng Task Force	448	1.4
Joint IEEE and ACM	440	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	406	1.3
IEICE-Inst Elec Info Comm Eng	402	1.3
ACS-Am Chem Soc	382	1.2
IET/IEE	313	1.0
414 others with less than 1% each	6502	17.3
Taiwan Semiconductor Manufacturing Co.		
IEEE	9489	36.8
American Institute of Physics	7246	28.1
RELX Group (Elsevier)	2327	9.0
Electrochemical Society, Inc.	889	3.5
IEEE/JPN Soc App Phys	840	3.3
Institute of Pure and Applied Physics	646	2.5
SPIE-Int Soc Opt Engineering	594	2.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	472	1.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	341	1.3
IET/IEE	280	1.1
MRS-Materials Research Soc	260	1.0
145 others with less than 1% each	2378	8.0

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
TCL Corp		
IEEE	134	21.6
3GPP General Partnership Project Standards Body	62	10.0
ACM-Assoc Comput Mach	60	9.7
Miller Freeman	43	6.9
Ziff-Davis	37	6.0
Time Inc.	25	4.0
Joint IEEE and ACM	21	3.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	20	3.2
RELX Group (Elsevier)	19	3.1
Penton/IPC, Inc.	18	2.9
Linley Group	18	2.9
Open Mobile Alliance (Standards Org)	16	2.6
International Data Group	15	2.4
ACS-Am Chem Soc	11	1.8
SPIE-Int Soc Opt Engineering	10	1.6
Internet Soc/IETF-Internet Eng Task Force	8	1.3
SID-Society for Information Display	8	1.3
American Institute of Physics	7	1.1
CBS Interactive	6	1.0
United Business Media/UBM Tech	6	1.0
GSM Association (standards org)	6	1.0
38 others with less than 1% each	70	11.9
Toshiba Corp		
IEEE	9249	40.3
American Institute of Physics	1765	7.7
RELX Group (Elsevier)	1453	6.3
IEEE/JPN Soc App Phys	884	3.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	730	3.2
American Physical Society	614	2.7
IEICE-Inst Elec Info Comm Eng	587	2.6
ACM-Assoc Comput Mach	537	2.3
SPIE-Int Soc Opt Engineering	472	2.1
Institute of Pure and Applied Physics	420	1.8
Internet Soc/IETF-Internet Eng Task Force	359	1.6
International Telecommunication Union	363	1.6
ACS-Am Chem Soc	339	1.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	330	1.4
AACS-Advanced Access Content System	299	1.3
Joint IEEE and ACM	249	1.1
IET/IEE	232	1.0
Japan Society of Applied Physics	225	1.0
376 others with less than 1% each	3825	13.0

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2019 Patent Activity; References from 1999-2019 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Toyota Motor Corp		
RELX Group (Elsevier)	1766	19.4
IEEE	1706	18.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	540	5.9
ACS-Am Chem Soc	536	5.9
American Society of Plant Biologists	375	4.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	357	3.9
American Institute of Physics	302	3.3
SAE-Society of Automobile Engineers	254	2.8
AAAS-Am Assoc Advancement Sci	215	2.4
MacMillan Publishing Company	223	2.4
Natl Acad Sciences	215	2.4
ACM-Assoc Comput Mach	212	2.3
Electrochemical Society, Inc.	168	1.8
Optical Society of America	156	1.7
Royal Society of Chemistry	120	1.3
Oxford Univ Press	116	1.3
National Institutes of Health - NIH	113	1.2
American SociETY for Microbiology	110	1.2
American Society for Biochemistry and Molecular Biology Inc.	98	1.1
249 others with less than 1% each	1537	14.0
United Technologies Corp		
IEEE	1710	13.8
NASA-National Aeronautics and Space Admin	1489	12.0
RELX Group (Elsevier)	965	7.8
ASME-Am Soc Mech Eng	969	7.8
IHS Markit	957	7.7
AIAA-Am Inst Aero Astro	673	5.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	562	4.5
SAE-Society of Automobile Engineers	547	4.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	311	2.5
ACS-Am Chem Soc	277	2.2
American Institute of Physics	269	2.2
Cambridge University Press	241	1.9
McGraw Hill	209	1.7
SAGE Publications Ltd	182	1.5
American Society of Mechanical Engineers	186	1.5
Optical Society of America	175	1.4
SPIE-Int Soc Opt Engineering	174	1.4
IOP Publishing	176	1.4
US Dept of Energy	159	1.3
www.dynamore.de	151	1.2
International Society or Air Breathing Engines (ISABE)	126	1.0
252 others with less than 1% each	1871	12.2

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>AI/Artificial Intelligence</i>										
1	Microsoft Corporation	2416	6201	39.0	IEEE	2416	39.0	ACM-Assoc Comput Mach	1763	28.4
2	International Business Machi	2034	5554	36.6	IEEE	2034	36.6	ACM-Assoc Comput Mach	789	14.2
3	Google Inc.	1775	3765	47.1	IEEE	1775	47.1	ACM-Assoc Comput Mach	473	12.6
4	Brain Corporation	1010	2362	42.8	IEEE	1010	42.8	MIT Press	418	17.7
5	Apple Inc	824	1536	53.6	IEEE	824	53.6	ACM-Assoc Comput Mach	398	25.9
6	HRL Laboratories LLC	734	1476	49.7	IEEE	734	49.7	RELX Group (Elsevier)	120	8.1
7	NUMENTA INC	644	2419	26.6	Numenta Inc.	852	35.2	IEEE	644	26.6
8	Qualcomm Inc	496	1226	40.5	IEEE	496	40.5	MIT Press	95	7.7
9	Adobe Inc.	302	523	57.7	IEEE	302	57.7	ACM-Assoc Comput Mach	124	23.7
10	Columbia University	266	695	38.3	IEEE	266	38.3	ACM-Assoc Comput Mach	99	14.2
11	Siemens Aktiengesellschaft	252	612	41.2	IEEE	252	41.2	RELX Group (Elsevier)	73	11.9
12	Xerox Corp	248	756	32.8	IEEE	248	32.8	ACM-Assoc Comput Mach	114	15.1
13	Cisco Systems Inc.	242	453	53.4	IEEE	242	53.4	ACM-Assoc Comput Mach	74	16.3
14	University of Alabama	238	277	85.9	IEEE	238	85.9	RELX Group (Elsevier)	13	4.7
15	General Electric Company	212	314	67.5	IEEE	212	67.5	RELX Group (Elsevier)	27	8.6
16	NEC Corp	206	439	46.9	IEEE	206	46.9	ACM-Assoc Comput Mach	48	10.9
17	Amazon.com Inc.	186	384	48.4	IEEE	186	48.4	ACM-Assoc Comput Mach	85	22.1
18	Cortica Ltd	186	258	72.1	IEEE	186	72.1	ACM-Assoc Comput Mach	23	8.9
19	Fujitsu Limited	186	433	43.0	IEEE	186	43.0	Joint IEEE and ACM	82	18.9
20	University of Tennessee Rese	186	293	63.5	IEEE	186	63.5	RELX Group (Elsevier)	18	6.1
21	Omni Ai Inc. Inc (formerly B	172	201	85.6	IEEE	172	85.6	International Association for Pattern Recognition (IAPR)	22	10.9
22	Samsung Electronics Co Ltd	171	322	53.1	IEEE	171	53.1	ACM-Assoc Comput Mach	33	10.2
23	SAS Institute	149	407	36.6	IEEE	149	36.6	RELX Group (Elsevier)	54	13.3
24	Intel Corporation	148	296	50.0	IEEE	148	50.0	ACM-Assoc Comput Mach	37	12.5
25	Sony Corp	145	316	45.9	IEEE	145	45.9	ACM-Assoc Comput Mach	36	11.4
26	United States Navy	129	232	55.6	IEEE	129	55.6	RELX Group (Elsevier)	33	14.2
27	Magic Leap Inc	128	163	78.5	IEEE	128	78.5	Neural Information Processing Systems Foundation	12	7.4
28	Arizona State University	127	167	76.0	IEEE	127	76.0	ACM-Assoc Comput Mach	13	7.8
29	ICOSYSTEM CORP	125	172	72.7	IEEE	125	72.7	RELX Group (Elsevier)	9	5.2
30	eBay Inc	122	161	75.8	IEEE	122	75.8	ACM-Assoc Comput Mach	14	8.7
31	Nuance Communications Inc	116	225	51.6	IEEE	116	51.6	ACM-Assoc Comput Mach	30	13.3
32	Massachusetts Institute of Te	114	376	30.3	IEEE	114	30.3	RELX Group (Elsevier)	29	7.7
33	Honda Motor Co. Ltd.	113	223	50.7	IEEE	113	50.7	RELX Group (Elsevier)	18	8.1
34	Oracle Corporation	113	433	26.1	IEEE	113	26.1	ACM-Assoc Comput Mach	112	25.9
35	Battelle Memorial Institute	110	147	74.8	IEEE	110	74.8	Springer/Sp. Wien/Springer-Verlag/KluwAcad	5	3.4
36	AT&T Inc	108	308	35.1	IEEE	108	35.1	ACM-Assoc Comput Mach	87	28.2
37	University of Illinois	104	249	41.8	IEEE	104	41.8	ACM-Assoc Comput Mach	30	12.0
38	FireEye Inc	103	290	35.5	IEEE	103	35.5	ACM-Assoc Comput Mach	53	18.3
39	NEURALA INC	103	150	68.7	IEEE	103	68.7	MIT Press	15	10.0

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	IP RESERVOIR LLC	102	169	60.4	IEEE	102	60.4	ACM-Assoc Comput Mach	28	16.6
41	Baidu Inc	101	161	62.7	IEEE	101	62.7	International Machine Learning Society (IMLS)	15	9.3
42	Boeing Co. (The)	101	289	34.9	IEEE	101	34.9	RELX Group (Elsevier)	44	15.2
43	University of California	101	1038	9.7	Oxford University Press	148	14.3	RELX Group (Elsevier)	136	13.1
44	Raytheon Co.	97	218	44.5	IEEE	97	44.5	SPIE-Int Soc Opt Engineering	19	8.7
45	PRIMAL FUSION INC	96	185	51.9	IEEE	96	51.9	ACM-Assoc Comput Mach	35	18.9
46	Verizon Communications Inc	95	456	20.8	ACM-Assoc Comput Mach	180	39.5	IEEE	95	20.8
47	Zebra Technologies Corp.	95	119	79.8	IEEE	95	79.8	ACM-Assoc Comput Mach	12	10.1
48	Cornell University	93	593	15.7	IEEE	93	15.7	RELX Group (Elsevier)	88	14.8
49	Aerospace Corp.	92	279	33.0	RELX Group (Elsevier)	96	34.4	IEEE	92	33.0
50	Accenture Ltd.	91	386	23.6	IEEE	91	23.6	ACM-Assoc Comput Mach	75	19.4
51	Lockheed Martin Corp.	91	135	67.4	IEEE	91	67.4	RELX Group (Elsevier)	11	8.1
52	GYRFALCON TECHNOLO	89	109	81.7	IEEE	89	81.7	American Institute of Physics	11	10.1
53	Marvell Technology Group Lt	85	142	59.9	IEEE	85	59.9	ACM-Assoc Comput Mach	41	28.9
54	ALOFT MEDIA LLC	79	147	53.7	IEEE	79	53.7	Institute for Operations Research and the Management Science	24	16.3
55	HP Inc	78	275	28.4	IEEE	78	28.4	ACM-Assoc Comput Mach	63	22.9
56	Nokia Corp	74	164	45.1	IEEE	74	45.1	ACM-Assoc Comput Mach	36	22.0
57	EXEGY INC	73	147	49.7	IEEE	73	49.7	ACM-Assoc Comput Mach	27	18.4
58	INDIVIDUAL PATENTER	73	165	44.2	IEEE	73	44.2	ACM-Assoc Comput Mach	30	18.2
59	Motorola Solutions Inc.	72	81	88.9	IEEE	72	88.9	International Association for Pattern Recognition (IAPR)	6	7.4
60	Micron Technology Inc.	71	102	69.6	IEEE	71	69.6	ACM-Assoc Comput Mach	5	4.9
61	Toyota Motor Corp	70	100	70.0	IEEE	70	70.0	RELX Group (Elsevier)	6	6.0
62	Mitsubishi Electric Corp	69	125	55.2	IEEE	69	55.2	ACM-Assoc Comput Mach	6	4.8
63	Sap SE	69	221	31.2	IEEE	69	31.2	ACM-Assoc Comput Mach	50	22.6
64	California Institute of Techno	68	209	32.5	IEEE	68	32.5	RELX Group (Elsevier)	16	7.7
65	ZOOX INC	67	82	81.7	IEEE	67	81.7	IEEE/RSJ	6	7.3
66	ConvergeOne Inc	66	154	42.9	IEEE	66	42.9	ACM-Assoc Comput Mach	30	19.5
67	VIA ALLIANCE SEMICON	66	249	26.5	Joint IEEE and ACM	67	26.9	IEEE	66	26.5
68	Twitter Inc	65	86	75.6	IEEE	65	75.6	International Machine Learning Society (IMLS)	6	7.0
69	Facebook Inc	64	174	36.8	IEEE	64	36.8	ACM-Assoc Comput Mach	52	29.9
70	INCEPTION INSTITUTE OF	62	72	86.1	IEEE	62	86.1	ACM-Assoc Comput Mach	8	11.1
71	Ohio State University	62	66	93.9	IEEE	62	93.9	American Automatic Control Council (AACC)	3	4.5
72	KNOWMTECH LLC	61	231	26.4	IEEE	61	26.4	American Institute of Physics	58	25.1
73	Purdue University	61	104	58.7	IEEE	61	58.7	ACM-Assoc Comput Mach	22	21.2
74	FACENSE LTD	60	72	83.3	IEEE	60	83.3	ACM-Assoc Comput Mach	8	11.1
75	Causam Energy Inc	59	67	88.1	IEEE	59	88.1	RELX Group (Elsevier)	3	4.5
76	CONDUENT BUSINESS SE	58	111	52.3	IEEE	58	52.3	ACM-Assoc Comput Mach	15	13.5
77	Symantec Corp.	56	194	28.9	IEEE	56	28.9	ACM-Assoc Comput Mach	48	24.7
78	Commissariat A L'Energie At	55	70	78.6	IEEE	55	78.6	RELX Group (Elsevier)	5	7.1
79	Xperi Corporation (Formerly	55	80	68.8	IEEE	55	68.8	ACM-Assoc Comput Mach	4	5.0
80	Toshiba Corp	54	85	63.5	IEEE	54	63.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	5	5.9

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Dell Technologies Inc	53	144	36.8	IEEE	53	36.8	ACM-Assoc Comput Mach	27	18.8
82	Bosch (Robert) GmbH	52	79	65.8	IEEE	52	65.8	IET/IEE	3	3.8
83	Rag Foundation	51	80	63.8	IEEE	51	63.8	RELX Group (Elsevier)	12	15.0
84	Rockwell Automation Inc	51	105	48.6	IEEE	51	48.6	RELX Group (Elsevier)	17	16.2
85	SOCIETE DE COMMERCIA	51	137	37.2	IEEE	51	37.2	RELX Group (Elsevier)	22	16.1
86	Knowles Corp	50	69	72.5	IEEE	50	72.5	RELX Group (Elsevier)	4	5.8
87	Canon Inc	49	108	45.4	IEEE	49	45.4	RELX Group (Elsevier)	12	11.1
88	United States of America Dep	49	134	36.6	IEEE	49	36.6	ACL - Association for Computational Linguistics	15	11.2
89	Emerson Electric Co.	48	91	52.7	IEEE	48	52.7	RELX Group (Elsevier)	9	9.9
90	University of Texas	47	79	59.5	IEEE	47	59.5	RELX Group (Elsevier)	17	21.5
91	Cleveland Clinic (and Founda	46	47	97.9	IEEE	46	97.9	MIT Press	1	2.1
92	Hitachi Ltd	45	77	58.4	IEEE	45	58.4	Information Processing Society of Japan	9	11.7
93	Huawei Technologies Compa	45	99	45.5	IEEE	45	45.5	3GPP General Partnership Project Standards Body	15	15.2
94	Walt Disney Co.	44	80	55.0	IEEE	44	55.0	ACM-Assoc Comput Mach	12	15.0
95	ASAPP INC	43	164	26.2	IEEE	43	26.2	MIT Press	36	22.0
96	Nevada System of Higher Ed	43	75	57.3	IEEE	43	57.3	RELX Group (Elsevier)	14	18.7
97	Honeywell International Inc.	41	115	35.7	IEEE	41	35.7	RELX Group (Elsevier)	33	28.7
98	23ANDME INC	40	81	49.4	IEEE	40	49.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	9.9
99	BAE Systems Plc.	40	77	51.9	IEEE	40	51.9	ACM-Assoc Comput Mach	5	6.5
100	PEGASYSTEMS INC	40	82	48.8	IEEE	40	48.8	ACM-Assoc Comput Mach	15	18.3

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Autonomous Vehicles</i>										
1	Irobot Corp	1595	2441	65.3	IEEE	1595	65.3	SPIE-Int Soc Opt Engineering	221	9.1
2	ZOOX INC	362	449	80.6	IEEE	362	80.6	IEEE/RSJ	31	6.9
3	Aptiv Plc (former Delphi Aut	155	223	69.5	IEEE	155	69.5	American Automatic Control Council (AACC)	14	6.3
4	Google Inc.	142	254	55.9	IEEE	142	55.9	ACM-Assoc Comput Mach	18	7.1
5	WALMART APOLLO LLC	135	186	72.6	IEEE	135	72.6	IEEE/RSJ	21	11.3
6	Brain Corporation	132	246	53.7	IEEE	132	53.7	MIT Press	25	10.2
7	Nio Co. Ltd	100	143	69.9	IEEE	100	69.9	ACM-Assoc Comput Mach	14	9.8
8	TUSIMPLE	96	114	84.2	IEEE	96	84.2	ACM-Assoc Comput Mach	10	8.8
9	Uber Technologies Inc	91	120	75.8	IEEE	91	75.8	Joint IEEE and ACM	9	7.5
10	State Farm Insurance Compa	77	243	31.7	IEEE	77	31.7	Intelligent Systems Design and Applications (ISDA)	36	14.8
11	International Business Machi	67	201	33.3	IEEE	67	33.3	IP.Com	28	13.9
12	IFLIGHT Innovation Technol	61	99	61.6	IEEE	61	61.6	SAGE Publications Ltd	7	7.1
13	California Institute of Techno	58	109	53.2	IEEE	58	53.2	American Automatic Control Council (AACC)	6	5.5
14	Toyota Motor Corp	54	77	70.1	IEEE	54	70.1	IEEE/RSJ	10	13.0
15	HRL Laboratories LLC	53	77	68.8	IEEE	53	68.8	IEEE/RSJ	13	16.9
16	Intel Corporation	50	68	73.5	IEEE	50	73.5	RELX Group (Elsevier)	2	2.9
17	PELTON TECHNOLOGY I	50	78	64.1	IEEE	50	64.1	American Automatic Control Council (AACC)	9	11.5
18	Ford Motor Co.	49	76	64.5	IEEE	49	64.5	IET/IEE	5	6.6
19	SPHERO INC	49	52	94.2	IEEE	49	94.2	American Automatic Control Council (AACC)	3	5.8
20	NURO INC	47	59	79.7	IEEE	47	79.7	IEEE/RSJ	4	6.8
21	University of Pennsylvania	44	55	80.0	IEEE	44	80.0	IEEE/RSJ	6	10.9
22	Boeing Co. (The)	42	80	52.5	IEEE	42	52.5	ACM-Assoc Comput Mach	4	5.0
23	Siemens Aktiengesellschaft	35	48	72.9	IEEE	35	72.9	ISIF/IEEE	3	6.3
24	Amazon.com Inc.	33	39	84.6	IEEE	33	84.6	Condé Nast	5	12.8
25	INTOUCH HEALTH INC	33	82	40.2	IEEE	33	40.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	6	7.3
26	Walmart Stores Inc	32	46	69.6	IEEE	32	69.6	IEEE/RSJ	6	13.0
27	Digimarc Corp.	31	59	52.5	IEEE	31	52.5	ACM-Assoc Comput Mach	11	18.6
28	Baidu Inc	27	40	67.5	IEEE	27	67.5	SAE-Society of Automobile Engineers	4	10.0
29	Deere & Co.	26	46	56.5	IEEE	26	56.5	International Association for Pattern Recognition (IAPR)	3	6.5
30	Oshkosh Corporation	23	30	76.7	IEEE	23	76.7	SAE-Society of Automobile Engineers	2	6.7
31	FedEx Corp	22	30	73.3	IEEE	22	73.3	RELX Group (Elsevier)	2	6.7
32	Toshiba Corp	22	23	95.7	IEEE	22	95.7	ACM-Assoc Comput Mach	1	4.3
33	TRIFO INC	22	25	88.0	IEEE	22	88.0	SAGE Publications Ltd	3	12.0
34	Garrett Motion (formerly Gar	21	27	77.8	IEEE	21	77.8	American Automatic Control Council (AACC)	5	18.5
35	NONEND INVENTIONS N	20	21	95.2	IEEE	20	95.2	The International Association for Computers and Communicati	1	4.8
36	APEX ARTIFICIAL INTELL	18	21	85.7	IEEE	18	85.7	MIT Press	3	14.3
37	Battelle Memorial Institute	18	24	75.0	IEEE	18	75.0	IEEE/RSJ	4	16.7
38	Lockheed Martin Corp.	15	51	29.4	American Institute of Physics	29	56.9	IEEE	15	29.4
39	AUTONOMOUS SOLUTIO	14	30	46.7	IEEE	14	46.7	American Automatic Control Council (AACC)	9	30.0

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	BRIAN CORP	14	17	82.4	IEEE	14	82.4	MIT Press	3	17.6
41	DEEPMAP INC	14	20	70.0	IEEE	14	70.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	2	10.0
42	General Motors Corp	13	24	54.2	IEEE	13	54.2	SAE-Society of Automobile Engineers	2	8.3
43	Qualcomm Inc	13	17	76.5	IEEE	13	76.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	11.8
44	Walt Disney Co.	13	13	100.0	IEEE	13	100.0			
45	Aviation Industry Corporatio	12	22	54.5	IEEE	12	54.5	SAE-Society of Automobile Engineers	10	45.5
46	ZYTEK COMMUNICATIO	12	44	27.3	IEEE	12	27.3	COMPANY OF BIOLOGISTS LTD	6	13.6
47	Honda Motor Co. Ltd.	11	19	57.9	IEEE	11	57.9	RELX Group (Elsevier)	3	15.8
48	PERRONE ROBOTICS INC	11	18	61.1	IEEE	11	61.1	IEEE/RSJ	4	22.2
49	EPISYS SCIENCE INC	10	14	71.4	IEEE	10	71.4	MIT Press	2	14.3
50	King Fahd University of Petr	10	13	76.9	IEEE	10	76.9	ISIF/IEEE	1	7.7
51	PERCEPTIN SHENZHEN L	10	11	90.9	IEEE	10	90.9	SAGE Publications Ltd	1	9.1
52	Raytheon Co.	9	21	42.9	IEEE	9	42.9	RELX Group (Elsevier)	3	14.3
53	Bosch (Robert) GmbH	8	11	72.7	IEEE	8	72.7	SAGE Publications Ltd	1	9.1
54	Casio Computer	8	8	100.0	IEEE	8	100.0			
55	Leidos Holdings Inc	8	10	80.0	IEEE	8	80.0	ISIF/IEEE	2	20.0
56	Porsche Automobil Holding S	8	9	88.9	IEEE	8	88.9	ASME-Am Soc Mech Eng	1	11.1
57	BAE Systems Plc.	7	12	58.3	IEEE	7	58.3	IEEE/RSJ	3	25.0
58	HANGZHOU ZERO ZERO	7	7	100.0	IEEE	7	100.0			
59	PERCEPTLN SHENZHEN L	7	8	87.5	IEEE	7	87.5	Society for Industrial and Applied Mathematics	1	12.5
60	UATC LLC	7	9	77.8	IEEE	7	77.8	IEEE/RSJ	1	11.1
61	Wipro Ltd	7	8	87.5	IEEE	7	87.5	RELX Group (Elsevier)	1	12.5
62	Aerospace Corp.	6	7	85.7	IEEE	6	85.7	American Automatic Control Council (AACC)	1	14.3
63	CRINKLAW FARM SERVI	6	6	100.0	IEEE	6	100.0			
64	Denso Corp	6	9	66.7	IEEE	6	66.7	RELX Group (Elsevier)	2	22.2
65	DRIVE AI INC	6	7	85.7	IEEE	6	85.7	Joint IEEE and ACM	1	14.3
66	Nissan Motor Co. Ltd.	6	12	50.0	IEEE	6	50.0	SAGE Publications Ltd	2	16.7
67	Nokia Corp	6	8	75.0	IEEE	6	75.0	IEEE/RSJ	1	12.5
68	Samsung Electronics Co Ltd	6	6	100.0	IEEE	6	100.0			
69	STRADVISION INC	6	8	75.0	IEEE	6	75.0	RELX Group (Elsevier)	2	25.0
70	University of Arkansas	6	6	100.0	IEEE	6	100.0			
71	X Development Llc	6	9	66.7	IEEE	6	66.7	CRC Press/Taylor & Francis	2	22.2
72	Arizona State University	5	10	50.0	IEEE	5	50.0	Joint IEEE and ACM	3	30.0
73	BEIJING INSTITUTE OF TE	5	5	100.0	IEEE	5	100.0			
74	Commonwealth Scientific an	5	9	55.6	IEEE	5	55.6	American Society of Civil Engineers	1	11.1
75	Hon Hai Precision Industry C	5	8	62.5	IEEE	5	62.5	RELX Group (Elsevier)	2	25.0
76	International Electronic Mach	5	10	50.0	IEEE	5	50.0	RELX Group (Elsevier)	3	30.0
77	Omron Corp.	5	14	35.7	IEEE	5	35.7	RELX Group (Elsevier)	4	28.6
78	Western Digital Corp.	5	5	100.0	IEEE	5	100.0			
79	ACTIVE KNOWLEDGE LT	4	4	100.0	IEEE	4	100.0			
80	Charles Stark Draper Laborat	4	4	100.0	IEEE	4	100.0			

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Crown Equipment Corporatio	4	9	44.4	IEEE	4	44.4	IEICE-Inst Elec Info Comm Eng	3	33.3
82	LANDING TECHNOLOGIE	4	6	66.7	IEEE	4	66.7	Society of Instrument and Control Engineers	1	16.7
83	LUMINAR TECHNOLOGIE	4	4	100.0	IEEE	4	100.0			
84	NXP Semiconductors NV	4	5	80.0	IEEE	4	80.0	IET/IEE	1	20.0
85	OPTIMAL RANGING INC	4	6	66.7	IEEE	4	66.7	RELX Group (Elsevier)	2	33.3
86	PERCEPTIN INC	4	4	100.0	IEEE	4	100.0			
87	STARSHIP TECHNOLOGIE	4	4	100.0	IEEE	4	100.0			
88	VECNA ROBOTICS INC	4	7	57.1	IEEE	4	57.1	Internet Soc/IETF-Internet Eng Task Force	1	14.3
89	Veoneer Inc.	4	4	100.0	IEEE	4	100.0			
90	AFFECTIVA INC	3	3	100.0	IEEE	3	100.0			
91	Allstate Corp	3	15	20.0	ACM-Assoc Comput Mach	6	40.0	IEEE	3	20.0
92	AURORA INNOVATION IN	3	3	100.0	IEEE	3	100.0			
93	BYTELIGHT INC	3	4	75.0	IEEE	3	75.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1	25.0
94	Carnegie Mellon University	3	3	100.0	IEEE	3	100.0			
95	Cisco Systems Inc.	3	5	60.0	IEEE	3	60.0	Joint IEEE and ACM	2	40.0
96	CLEARMOTION INC	3	3	100.0	IEEE	3	100.0			
97	COGNATA LTD	3	4	75.0	IEEE	3	75.0	SAE-Society of Automobile Engineers	1	25.0
98	Delphi Technologies Inc	3	4	75.0	IEEE	3	75.0	IEEE/RSJ	1	25.0
99	DRIVENT TECHNOLOGIES	3	6	50.0	IEEE	3	50.0	DOW JONES & CO, INC	3	50.0
100	Dura Automotive Systems. In	3	4	75.0	IEEE	3	75.0	SAGE Publications Ltd	1	25.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Blockchain/Distributed Ledger</i>										
1	IP RESERVOIR LLC	82	152	53.9	IEEE	82	53.9	ACM-Assoc Comput Mach	26	17.1
2	Cisco Systems Inc.	42	63	66.7	IEEE	42	66.7	ACM-Assoc Comput Mach	5	7.9
3	Juniper Networks Inc.	35	38	92.1	IEEE	35	92.1	Defense Advanced Research Projects Agency (DARPA)	1	2.6
4	Marvell Technology Group Lt	28	28	100.0	IEEE	28	100.0			
5	Dell Technologies Inc	14	46	30.4	ACM-Assoc Comput Mach	24	52.2	IEEE	14	30.4
6	Accenture Ltd.	13	56	23.2	ACM-Assoc Comput Mach	29	51.8	IEEE	13	23.2
7	International Business Machi	11	43	25.6	IEEE	11	25.6	IP.Com	5	11.6
8	Via Technologies Inc.	9	16	56.3	IEEE	9	56.3	Joint IEEE and ACM	2	12.5
9	Amazon.com Inc.	8	10	80.0	IEEE	8	80.0	ACM-Assoc Comput Mach	2	20.0
10	LG Electronics Inc.	8	9	88.9	IEEE	8	88.9	World Academy of Science Engineering and Technology	1	11.1
11	ANTHURIUM SOLUTIONS	7	42	16.7	ACM-Assoc Comput Mach	15	35.7	IEEE	7	16.7
12	FACTOM INC	6	6	100.0	IEEE	6	100.0			
13	Sap SE	5	12	41.7	IEEE	5	41.7	ACM-Assoc Comput Mach	2	16.7
14	BLOCKCHAIN ASICS LLC	4	4	100.0	IEEE	4	100.0			
15	ESHARD	4	8	50.0	IET/IEE	4	50.0	IEEE	4	50.0
16	FARMOBILE LLC	3	3	100.0	IEEE	3	100.0			
17	Raytheon Co.	3	3	100.0	IEEE	3	100.0			
18	AT&T Inc	2	2	100.0	IEEE	2	100.0			
19	CME Group Inc	2	8	25.0	FORBES INC	4	50.0	IEEE	2	25.0
20	Global Foundries Inc	2	4	50.0	IEEE	2	50.0	RELX Group (Elsevier)	1	25.0
21	HOVERKEY LTD	2	2	100.0	IEEE	2	100.0			
22	Intel Corporation	2	6	33.3	Federal Information Processing Standards Pub	2	33.3	IEEE	2	33.3
23	Johnson Controls Internationa	2	3	66.7	IEEE	2	66.7	Internet Soc/IETF-Internet Eng Task Force	1	33.3
24	MasterCard Inc	2	7	28.6	ACM-Assoc Comput Mach	3	42.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	28.6
25	MILESTONE ENTERTAIN	2	10	20.0	IEEE	2	20.0	MIT Press	1	10.0
26	National Chiao Tung Univers	2	3	66.7	IEEE	2	66.7	World Wide Web Consortium	1	33.3
27	NEC Corp	2	2	100.0	IEEE	2	100.0			
28	OBOPAY INC	2	4	50.0	IEEE	2	50.0	I B C BUSINESS PUBL LTD, MORTIMER HOUSE, 37-41	1	25.0
29	SYMBIONT IO INC	2	6	33.3	ACM-Assoc Comput Mach	2	33.3	IEEE	2	33.3
30	THE BANK OF NEW YORK	2	2	100.0	IEEE	2	100.0			
31	TiVo Corp	2	2	100.0	IEEE	2	100.0			
32	TURING TECHNOLOGY IN	2	2	100.0	IEEE	2	100.0			
33	ACCELOR LTD	1	1	100.0	IEEE	1	100.0			
34	ALTR SOLUTIONS INC	1	2	50.0	ACM-Assoc Comput Mach	1	50.0	IEEE	1	50.0
35	AMRICAN EXPRESS TRA	1	2	50.0	ACM-Assoc Comput Mach	1	50.0	IEEE	1	50.0
36	Bank of America Corp.	1	21	4.8	New York Times	18	85.7	Source Media	1	4.8
37	Broadcom Ltd	1	2	50.0	IEEE	1	50.0	ACM-Assoc Comput Mach	1	50.0
38	CHONGQING JINKANG NE	1	1	100.0	IEEE	1	100.0			
39	CYBERARK SOFTWARE L	1	1	100.0	IEEE	1	100.0			

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	ENT TECHNOLOGIES INC	1	1	100.0	IEEE	1	100.0			
41	GSC SECURE LLC	1	15	6.7	ACM-Assoc Comput Mach	14	93.3	IEEE	1	6.7
42	HRL Laboratories LLC	1	5	20.0	ACM-Assoc Comput Mach	3	60.0	Joint IEEE and ACM	1	20.0
43	McAfee Inc	1	2	50.0	IEEE	1	50.0	ACM-Assoc Comput Mach	1	50.0
44	McKesson Corporation	1	4	25.0	ACM-Assoc Comput Mach	2	50.0	Joint IEEE and ACM	1	25.0
45	Microsoft Corporation	1	14	7.1	ACM-Assoc Comput Mach	6	42.9	IFIP - International Federation for Information Processing	2	14.3
46	MOCANA CORP	1	1	100.0	IEEE	1	100.0			
47	Nant Holdings IP Llc	1	1	100.0	IEEE	1	100.0			
48	O2i SA	1	1	100.0	IEEE	1	100.0			
49	PANJIVA INC	1	1	100.0	IEEE	1	100.0			
50	REFINITIV US ORGANIZA	1	1	100.0	IEEE	1	100.0			
51	Samsung Electronics Co Ltd	1	1	100.0	IEEE	1	100.0			
52	SF MOTORS INC	1	1	100.0	IEEE	1	100.0			
53	SKUCHAIN INC	1	2	50.0	Internet Soc/IETF-Internet Eng Task Force	1	50.0	IEEE	1	50.0
54	Sony Corp	1	1	100.0	IEEE	1	100.0			
55	Square Inc	1	1	100.0	IEEE	1	100.0			
56	SS8 NETWORKS INC	1	3	33.3	Internet Soc/IETF-Internet Eng Task Force	2	66.7	IEEE	1	33.3
57	Texas Instruments Inc	1	1	100.0	IEEE	1	100.0			
58	THE TORONTO-DOMINIO	1	7	14.3	World Wide Web Consortium	3	42.9	Imagine Publishing	3	42.9
59	WALMART APOLLO LLC	1	4	25.0	Ziff-Davis	1	25.0	Australian comp soc	1	25.0

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<i>Broadcasting</i>										
1	Microsoft Corporation	10336	21016	49.2	IEEE	10336	49.2	ACM-Assoc Comput Mach	2597	12.4
2	Personalized Media Commun	7844	47470	16.5	Society of Motion Picture and Television Engi	14398	30.3	IEEE	7844	16.5
3	Xperi Corporation (Formerly	5495	9021	60.9	IEEE	5495	60.9	ACM-Assoc Comput Mach	822	9.1
4	Qualcomm Inc	4786	19033	25.1	International Telecommunication Union	7189	37.8	IEEE	4786	25.1
5	Google Inc.	4267	10825	39.4	IEEE	4267	39.4	ACM-Assoc Comput Mach	1649	15.2
6	Sony Corp	3426	8165	42.0	IEEE	3426	42.0	International Telecommunication Union	1295	15.9
7	Magna International Inc.	3213	5032	63.9	IEEE	3213	63.9	SAE-Society of Automobile Engineers	265	5.3
8	Pelican Imaging Corporation	2448	5057	48.4	IEEE	2448	48.4	SPIE-Int Soc Opt Engineering	804	15.9
9	Apple Inc	2423	5927	40.9	IEEE	2423	40.9	ACM-Assoc Comput Mach	626	10.6
10	TiVo Corp	2239	8227	27.2	IEEE	2239	27.2	ACM-Assoc Comput Mach	664	8.1
11	AT&T Inc	2193	4724	46.4	IEEE	2193	46.4	ACM-Assoc Comput Mach	399	8.4
12	Samsung Electronics Co Ltd	1995	5960	33.5	IEEE	1995	33.5	International Telecommunication Union	1297	21.8
13	Technicolor SA	1980	4199	47.2	IEEE	1980	47.2	ISO/IEC/JTC/ANSI	278	6.6
14	Cisco Systems Inc.	1921	4733	40.6	IEEE	1921	40.6	ACM-Assoc Comput Mach	368	7.8
15	Broadcom Ltd	1794	2802	64.0	IEEE	1794	64.0	ACM-Assoc Comput Mach	167	6.0
16	LG Electronics Inc.	1714	7188	23.8	IEEE	1714	23.8	ISO/IEC/JTC/ANSI	1197	16.7
17	Dolby Laboratories Inc	1583	4497	35.2	IEEE	1583	35.2	International Telecommunication Union	963	21.4
18	Panasonic Corporation	1528	4739	32.2	IEEE	1528	32.2	International Telecommunication Union	1272	26.8
19	Intel Corporation	1259	2813	44.8	IEEE	1259	44.8	3GPP General Partnership Project Standards Body	638	22.7
20	Massachusetts Institute of Te	1235	1872	66.0	IEEE	1235	66.0	ACM-Assoc Comput Mach	199	10.6
21	Hon Hai Precision Industry C	1213	3533	34.3	IEEE	1213	34.3	International Telecommunication Union	602	17.0
22	Nokia Corp	1189	2758	43.1	IEEE	1189	43.1	International Telecommunication Union	282	10.2
23	Adobe Inc.	1187	2483	47.8	IEEE	1187	47.8	ACM-Assoc Comput Mach	545	21.9
24	Fraunhofer Gesellschaft	1145	2397	47.8	IEEE	1145	47.8	MPEG.org	235	9.8
25	Canon Inc	980	2596	37.8	IEEE	980	37.8	International Telecommunication Union	313	12.1
26	International Business Machi	972	2621	37.1	IEEE	972	37.1	ACM-Assoc Comput Mach	419	16.0
27	NETWORK-1 TECHNOLOG	894	2053	43.5	IEEE	894	43.5	ACM-Assoc Comput Mach	596	29.0
28	InterDigital Inc	852	1966	43.3	IEEE	852	43.3	3GPP General Partnership Project Standards Body	480	24.4
29	Sonos Inc	841	1794	46.9	IEEE	841	46.9	SPIE-Int Soc Opt Engineering	229	12.8
30	STMicroelectronics	806	1194	67.5	IEEE	806	67.5	RELX Group (Elsevier)	52	4.4
31	Commscope Inc.	772	1669	46.3	IEEE	772	46.3	International Telecommunication Union	85	5.1
32	Huawei Technologies Compa	755	2399	31.5	International Telecommunication Union	783	32.6	IEEE	755	31.5
33	HP Inc	724	1555	46.6	IEEE	724	46.6	ACM-Assoc Comput Mach	188	12.1
34	INTOUCH HEALTH INC	647	1234	52.4	IEEE	647	52.4	IEEE/RSJ	74	6.0
35	Ricoh Co. Ltd.	644	1383	46.6	IEEE	644	46.6	ACM-Assoc Comput Mach	177	12.8
36	GoPro Inc	634	962	65.9	IEEE	634	65.9	ACM-Assoc Comput Mach	114	11.9
37	California Institute of Techno	587	1068	55.0	IEEE	587	55.0	SPIE-Int Soc Opt Engineering	84	7.9
38	Digimarc Corp.	581	1324	43.9	IEEE	581	43.9	SPIE-Int Soc Opt Engineering	188	14.2
39	General Electric Company	581	1370	42.4	IEEE	581	42.4	International Telecommunication Union	300	21.9

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Honeywell International Inc.	555	956	58.1	IEEE	555	58.1	SPIE-Int Soc Opt Engineering	82	8.6
41	Mitsubishi Electric Corp	517	1154	44.8	IEEE	517	44.8	International Telecommunication Union	134	11.6
42	Koninklijke Philips N.V.	503	1068	47.1	IEEE	503	47.1	ACM-Assoc Comput Mach	90	8.4
43	Wisteria Trading Inc	495	974	50.8	IEEE	495	50.8	SPIE-Int Soc Opt Engineering	104	10.7
44	Columbia University	491	882	55.7	IEEE	491	55.7	ACM-Assoc Comput Mach	134	15.2
45	Blackberry Ltd.	489	990	49.4	IEEE	489	49.4	3GPP General Partnership Project Standards Body	146	14.7
46	Xerox Corp	477	1149	41.5	IEEE	477	41.5	SPIE-Int Soc Opt Engineering	166	14.4
47	PixelWorks Inc	468	697	67.1	IEEE	468	67.1	SPIE-Int Soc Opt Engineering	61	8.8
48	Toshiba Corp	463	1182	39.2	IEEE	463	39.2	International Telecommunication Union	257	21.7
49	Verance Corp	436	857	50.9	IEEE	436	50.9	SPIE-Int Soc Opt Engineering	106	12.4
50	Nippon Telegraph & Telepho	422	1179	35.8	IEEE	422	35.8	International Telecommunication Union	252	21.4
51	ACACIA MEDIA TECHNO	408	738	55.3	IEEE	408	55.3	ACM-Assoc Comput Mach	66	8.9
52	Ericsson	405	1377	29.4	IEEE	405	29.4	International Telecommunication Union	193	14.0
53	Fuji Film Holdings Corp	381	1138	33.5	IEEE	381	33.5	ACM-Assoc Comput Mach	267	23.5
54	Industrial Technology Researc	372	558	66.7	IEEE	372	66.7	SPIE-Int Soc Opt Engineering	39	7.0
55	EchoStar Corp	362	711	50.9	IEEE	362	50.9	RELX Group (Elsevier)	56	7.9
56	Motorola Solutions Inc.	362	560	64.6	IEEE	362	64.6	ACM-Assoc Comput Mach	37	6.6
57	Walt Disney Co.	353	918	38.5	IEEE	353	38.5	ACM-Assoc Comput Mach	331	36.1
58	Marvell Technology Group Lt	343	416	82.5	IEEE	343	82.5	SPIE-Int Soc Opt Engineering	8	1.9
59	Semiconductor Energy Labor	336	2671	12.6	SID-Society for Information Display	801	30.0	American Institute of Physics	521	19.5
60	NEC Corp	334	726	46.0	IEEE	334	46.0	International Telecommunication Union	66	9.1
61	On Semiconductor Corporati	326	456	71.5	IEEE	326	71.5	SPIE-Int Soc Opt Engineering	43	9.4
62	Texas Instruments Inc	322	1020	31.6	International Telecommunication Union	502	49.2	IEEE	322	31.6
63	Electronics and Telecommuni	321	1131	28.4	International Telecommunication Union	448	39.6	IEEE	321	28.4
64	Amazon.com Inc.	315	681	46.3	IEEE	315	46.3	ACM-Assoc Comput Mach	156	22.9
65	Nielsen Holdings Plc	308	1617	19.0	IEEE	308	19.0	RELX Group (Elsevier)	191	11.8
66	University of Minnesota (The	291	358	81.3	IEEE	291	81.3	ACM-Assoc Comput Mach	13	3.6
67	Omnivision Technologies Inc	282	456	61.8	IEEE	282	61.8	SPIE-Int Soc Opt Engineering	64	14.0
68	REARDEN LLC	281	385	73.0	IEEE	281	73.0	Optical Society of America	21	5.5
69	ECOLE DE TECHBOLOGIE	271	416	65.1	IEEE	271	65.1	3GPP General Partnership Project Standards Body	40	9.6
70	NVIDIA Corp.	264	597	44.2	IEEE	264	44.2	ACM-Assoc Comput Mach	113	18.9
71	SUN PATENT TRUST	259	2002	12.9	International Telecommunication Union	1299	64.9	IEEE	259	12.9
72	Micron Technology Inc.	256	435	58.9	IEEE	256	58.9	SPIE-Int Soc Opt Engineering	55	12.6
73	BLACK HILLS MEDIA LLC	255	1049	24.3	Open Connectivity Foundation	513	48.9	IEEE	255	24.3
74	EUCLID DISCOVERIES LL	255	471	54.1	IEEE	255	54.1	RELX Group (Elsevier)	103	21.9
75	Cortica Ltd	249	330	75.5	IEEE	249	75.5	ACM-Assoc Comput Mach	31	9.4
76	BT Group PLC	248	448	55.4	IEEE	248	55.4	RELX Group (Elsevier)	37	8.3
77	Eastman Kodak Company	248	747	33.2	IEEE	248	33.2	SPIE-Int Soc Opt Engineering	89	11.9
78	ARC DEVICES LTD	240	819	29.3	ACM-Assoc Comput Mach	390	47.6	IEEE	240	29.3
79	CONVERGENT MEDIA SO	240	954	25.2	ACM-Assoc Comput Mach	257	26.9	IEEE	240	25.2
80	United States Navy	238	484	49.2	IEEE	238	49.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	58	12.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	University of California	236	500	47.2	IEEE	236	47.2	ACM-Assoc Comput Mach	34	6.8
82	Avid Technology Inc.	235	528	44.5	IEEE	235	44.5	ACM-Assoc Comput Mach	160	30.3
83	Sigma Corp	232	292	79.5	IEEE	232	79.5	SPIE-Int Soc Opt Engineering	40	13.7
84	Seiko Epson Corporation	229	452	50.7	IEEE	229	50.7	ACM-Assoc Comput Mach	35	7.7
85	Mediatek Inc.	222	530	41.9	IEEE	222	41.9	International Telecommunication Union	203	38.3
86	Siemens Aktiengesellschaft	221	469	47.1	IEEE	221	47.1	International Telecommunication Union	33	7.0
87	Comcast Corp	220	797	27.6	IEEE	220	27.6	ACM-Assoc Comput Mach	184	23.1
88	INTERVAL RESEARCH CO	216	437	49.4	IEEE	216	49.4	ACM-Assoc Comput Mach	29	6.6
89	Stanford University	211	551	38.3	IEEE	211	38.3	ACM-Assoc Comput Mach	106	19.2
90	University of North Carolina	211	481	43.9	IEEE	211	43.9	ACM-Assoc Comput Mach	138	28.7
91	FACENSE LTD	209	252	82.9	IEEE	209	82.9	ACM-Assoc Comput Mach	29	11.5
92	Hitachi Ltd	209	756	27.6	IEEE	209	27.6	IEICE-Inst Elec Info Comm Eng	67	8.9
93	IMAX Corp	207	407	50.9	IEEE	207	50.9	SPIE-Int Soc Opt Engineering	84	20.6
94	Kofax Inc	196	501	39.1	IEEE	196	39.1	ACM-Assoc Comput Mach	78	15.6
95	Ford Motor Co.	189	314	60.2	IEEE	189	60.2	IEEE/RSJ	24	7.6
96	Orange	189	307	61.6	IEEE	189	61.6	SPIE-Int Soc Opt Engineering	19	6.2
97	Intellectual Ventures Manage	186	441	42.2	IEEE	186	42.2	ACM-Assoc Comput Mach	87	19.7
98	SRI International	183	289	63.3	IEEE	183	63.3	RELX Group (Elsevier)	20	6.9
99	REALTIME DATA LLC	182	648	28.1	IEEE	182	28.1	Network Working Group RFC	79	12.2
100	Fujitsu Limited	177	620	28.5	IEEE	177	28.5	International Telecommunication Union	121	19.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Hardware</i>										
1	International Business Machi	17447	56661	30.8	IEEE	17447	30.8	ACM-Assoc Comput Mach	14028	24.8
2	Microsoft Corporation	15026	55667	27.0	ACM-Assoc Comput Mach	20512	36.8	IEEE	15026	27.0
3	Apple Inc	10415	29309	35.5	IEEE	10415	35.5	ACM-Assoc Comput Mach	9502	32.4
4	Intel Corporation	9591	20001	48.0	IEEE	9591	48.0	ACM-Assoc Comput Mach	2657	13.3
5	Oracle Corporation	4846	17662	27.4	ACM-Assoc Comput Mach	6311	35.7	IEEE	4846	27.4
6	Broadcom Ltd	4154	7238	57.4	IEEE	4154	57.4	ACM-Assoc Comput Mach	612	8.5
7	Google Inc.	4074	13510	30.2	IEEE	4074	30.2	ACM-Assoc Comput Mach	3999	29.6
8	Immersion Corp.	3943	10531	37.4	IEEE	3943	37.4	ACM-Assoc Comput Mach	1289	12.2
9	Cadence Design Systems Inc	3621	8995	40.3	IEEE	3621	40.3	Joint IEEE and ACM	3185	35.4
10	Qualcomm Inc	3332	7811	42.7	IEEE	3332	42.7	ACM-Assoc Comput Mach	571	7.3
11	Samsung Electronics Co Ltd	3248	8088	40.2	IEEE	3248	40.2	ACM-Assoc Comput Mach	808	10.0
12	Sony Corp	3210	7372	43.5	IEEE	3210	43.5	ACM-Assoc Comput Mach	1094	14.8
13	HP Inc	2540	8330	30.5	IEEE	2540	30.5	ACM-Assoc Comput Mach	1703	20.4
14	Ricoh Co. Ltd.	2454	5144	47.7	IEEE	2454	47.7	ACM-Assoc Comput Mach	891	17.3
15	Canon Inc	2418	6066	39.9	IEEE	2418	39.9	RELX Group (Elsevier)	546	9.0
16	Nokia Corp	2347	5596	41.9	IEEE	2347	41.9	ACM-Assoc Comput Mach	801	14.3
17	Siemens Aktiengesellschaft	2015	4181	48.2	IEEE	2015	48.2	Joint IEEE and ACM	549	13.1
18	Fujitsu Limited	1983	5014	39.5	IEEE	1983	39.5	ACM-Assoc Comput Mach	575	11.5
19	MicroUnity Systems Enginee	1859	3053	60.9	IEEE	1859	60.9	Joint IEEE and ACM	267	8.7
20	AT&T Inc	1731	4435	39.0	IEEE	1731	39.0	ACM-Assoc Comput Mach	885	20.0
21	Xilinx Inc.	1692	4079	41.5	IEEE	1692	41.5	ACM-Assoc Comput Mach	1259	30.9
22	Micron Technology Inc.	1682	2978	56.5	IEEE	1682	56.5	ACM-Assoc Comput Mach	232	7.8
23	Cisco Systems Inc.	1679	5054	33.2	IEEE	1679	33.2	Internet Soc/IETF-Internet Eng Task Force	808	16.0
24	Panasonic Corporation	1677	4068	41.2	IEEE	1677	41.2	International Telecommunication Union	306	7.5
25	Rambus Inc.	1664	2319	71.8	IEEE	1664	71.8	JEDEC Semiconductor Standards Organization	100	4.3
26	Personalized Media Commun	1592	10363	15.4	Society of Motion Picture and Television Engi	3113	30.0	IEEE	1592	15.4
27	Commvault Systems Inc.	1466	2226	65.9	IEEE	1466	65.9	ACM-Assoc Comput Mach	358	16.1
28	NEC Corp	1460	3439	42.5	IEEE	1460	42.5	ACM-Assoc Comput Mach	442	12.9
29	Dell Technologies Inc	1423	4760	29.9	ACM-Assoc Comput Mach	1469	30.9	IEEE	1423	29.9
30	Honeywell International Inc.	1409	3706	38.0	IEEE	1409	38.0	RELX Group (Elsevier)	282	7.6
31	Synopsys Inc.	1406	3571	39.4	IEEE	1406	39.4	Joint IEEE and ACM	819	22.9
32	Advanced Micro Devices Inc	1368	3599	38.0	IEEE	1368	38.0	Joint IEEE and ACM	549	15.3
33	Toshiba Corp	1321	3025	43.7	IEEE	1321	43.7	ACM-Assoc Comput Mach	236	7.8
34	Seiko Epson Corporation	1309	3635	36.0	IEEE	1309	36.0	Joint IEEE and ACM	513	14.1
35	Columbia University	1272	4414	28.8	IEEE	1272	28.8	ACM-Assoc Comput Mach	1010	22.9
36	Ignis Innovation Inc	1267	1565	81.0	IEEE	1267	81.0	SID-Society for Information Display	137	8.8
37	Cypress Semiconductor Corp.	1189	1897	62.7	IEEE	1189	62.7	Joint IEEE and ACM	239	12.6
38	PACT XPP TECHNOLOGIE	1186	2007	59.1	IEEE	1186	59.1	ACM-Assoc Comput Mach	192	9.6
39	Sap SE	1151	4512	25.5	ACM-Assoc Comput Mach	1514	33.6	IEEE	1151	25.5

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	IP RESERVOIR LLC	1131	2111	53.6	IEEE	1131	53.6	ACM-Assoc Comput Mach	375	17.8
41	Marvell Technology Group Lt	1131	1636	69.1	IEEE	1131	69.1	ACM-Assoc Comput Mach	106	6.5
42	STMicroelectronics	1103	1912	57.7	IEEE	1103	57.7	ACM-Assoc Comput Mach	108	5.6
43	Semiconductor Energy Labor	1074	11339	9.5	SID-Society for Information Display	4009	35.4	American Institute of Physics	2071	18.3
44	Hitachi Ltd	1067	3817	28.0	IEEE	1067	28.0	ACM-Assoc Comput Mach	670	17.6
45	Xperi Corporation (Formerly	1058	1638	64.6	IEEE	1058	64.6	RELX Group (Elsevier)	111	6.8
46	Xerox Corp	1057	4237	24.9	ACM-Assoc Comput Mach	1131	26.7	IEEE	1057	24.9
47	Blackberry Ltd.	1014	2553	39.7	IEEE	1014	39.7	ACM-Assoc Comput Mach	351	13.7
48	Adobe Inc.	939	3182	29.5	ACM-Assoc Comput Mach	1359	42.7	IEEE	939	29.5
49	Massachusetts Institute of Te	936	2081	45.0	IEEE	936	45.0	ACM-Assoc Comput Mach	340	16.3
50	Texas Instruments Inc	923	1696	54.4	IEEE	923	54.4	Joint IEEE and ACM	136	8.0
51	Softbank Corp	918	1864	49.2	IEEE	918	49.2	Joint IEEE and ACM	279	15.0
52	Amazon.com Inc.	905	3103	29.2	ACM-Assoc Comput Mach	1043	33.6	IEEE	905	29.2
53	Technicolor SA	876	1550	56.5	IEEE	876	56.5	ACM-Assoc Comput Mach	136	8.8
54	Tabula Inc	873	2330	37.5	IEEE	873	37.5	ACM-Assoc Comput Mach	864	37.1
55	Fraunhofer Gesellschaft	847	1448	58.5	IEEE	847	58.5	Audio Eng Soc	105	7.3
56	Huawei Technologies Compa	840	2569	32.7	IEEE	840	32.7	3GPP General Partnership Project Standards Body	335	13.0
57	SRC Computers Inc.	814	911	89.4	IEEE	814	89.4	ACM-Assoc Comput Mach	30	3.3
58	Hon Hai Precision Industry C	784	3332	23.5	IEEE	784	23.5	SID-Society for Information Display	485	14.6
59	Imagination Technologies Gr	757	2379	31.8	IEEE	757	31.8	ACM-Assoc Comput Mach	451	19.0
60	Fuji Film Holdings Corp	714	2098	34.0	IEEE	714	34.0	ACM-Assoc Comput Mach	528	25.2
61	Brain Corporation	713	1824	39.1	IEEE	713	39.1	MIT Press	354	19.4
62	NXP Semiconductors NV	706	1220	57.9	IEEE	706	57.9	Joint IEEE and ACM	175	14.3
63	LG Electronics Inc.	701	2357	29.7	IEEE	701	29.7	Audio Eng Soc	340	14.4
64	Tela Innovations inc	695	1853	37.5	IEEE	695	37.5	SPIE-Int Soc Opt Engineering	538	29.0
65	Western Digital Corp.	691	1867	37.0	IEEE	691	37.0	ACM-Assoc Comput Mach	256	13.7
66	University of California	678	3184	21.3	IEEE	678	21.3	RELX Group (Elsevier)	385	12.1
67	Mitsubishi Electric Corp	674	1478	45.6	IEEE	674	45.6	ACM-Assoc Comput Mach	247	16.7
68	NVIDIA Corp.	672	1681	40.0	IEEE	672	40.0	ACM-Assoc Comput Mach	485	28.9
69	Koninklijke Philips N.V.	656	1665	39.4	IEEE	656	39.4	RELX Group (Elsevier)	149	8.9
70	Sonos Inc	653	1313	49.7	IEEE	653	49.7	SPIE-Int Soc Opt Engineering	148	11.3
71	Netapp Inc	645	3102	20.8	ACM-Assoc Comput Mach	1301	41.9	IEEE	645	20.8
72	ConvergeOne Inc	642	1931	33.2	IEEE	642	33.2	Joint IEEE and ACM	634	32.8
73	Ericsson	642	1992	32.2	IEEE	642	32.2	3GPP General Partnership Project Standards Body	310	15.6
74	Hewlett Packard Enterprises	642	2055	31.2	ACM-Assoc Comput Mach	691	33.6	IEEE	642	31.2
75	General Electric Company	629	1633	38.5	IEEE	629	38.5	RELX Group (Elsevier)	162	9.9
76	FireEye Inc	613	1616	37.9	IEEE	613	37.9	ACM-Assoc Comput Mach	317	19.6
77	Citrix Systems Inc	609	1822	33.4	IEEE	609	33.4	ACM-Assoc Comput Mach	270	14.8
78	Conversant Intellectual Prope	589	819	71.9	IEEE	589	71.9	Joint IEEE and ACM	54	6.6
79	Silverbrook Pty Ltd	588	1485	39.6	IEEE	588	39.6	RELX Group (Elsevier)	292	19.7
80	Irobot Corp	587	1123	52.3	IEEE	587	52.3	SPIE-Int Soc Opt Engineering	231	20.6

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Motorola Solutions Inc.	583	1044	55.8	IEEE	583	55.8	ACM-Assoc Comput Mach	115	11.0
82	Verizon Communications Inc	578	3009	19.2	ACM-Assoc Comput Mach	836	27.8	IEEE	578	19.2
83	National Instruments Corp.	564	1071	52.7	IEEE	564	52.7	ACM-Assoc Comput Mach	134	12.5
84	RPX Corp	562	1357	41.4	IEEE	562	41.4	Internet Soc/IETF-Internet Eng Task Force	147	10.8
85	HRL Laboratories LLC	553	1163	47.5	IEEE	553	47.5	ACM-Assoc Comput Mach	144	12.4
86	Math Works Inc (The)	548	1265	43.3	IEEE	548	43.3	ACM-Assoc Comput Mach	287	22.7
87	Industrial Technology Researc	532	981	54.2	IEEE	532	54.2	ACM-Assoc Comput Mach	92	9.4
88	Texas A&M University	525	610	86.1	IEEE	525	86.1	American Physical Society	13	2.1
89	Murata Manufacturing Co. Lt	524	681	76.9	IEEE	524	76.9	RELX Group (Elsevier)	23	3.4
90	CREATIVE KINGDOMS LL	512	1654	31.0	IEEE	512	31.0	ACM-Assoc Comput Mach	447	27.0
91	Raytheon Co.	505	1254	40.3	IEEE	505	40.3	ACM-Assoc Comput Mach	131	10.4
92	Washington University in St.	504	1166	43.2	IEEE	504	43.2	ACM-Assoc Comput Mach	127	10.9
93	Electronics and Telecommuni	501	1076	46.6	IEEE	501	46.6	ACM-Assoc Comput Mach	121	11.2
94	ABB Ltd	495	763	64.9	IEEE	495	64.9	IVI Foundation/SCPI Consortium	93	12.2
95	Arizona State University	489	820	59.6	IEEE	489	59.6	Joint IEEE and ACM	86	10.5
96	INDIVIDUAL PATENTER	474	2250	21.1	IEEE	474	21.1	RELX Group (Elsevier)	295	13.1
97	EXEGY INC	473	916	51.6	IEEE	473	51.6	ACM-Assoc Comput Mach	150	16.4
98	Symantec Corp.	471	1841	25.6	IEEE	471	25.6	ACM-Assoc Comput Mach	404	21.9
99	Digimarc Corp.	457	1265	36.1	IEEE	457	36.1	ACM-Assoc Comput Mach	199	15.7
100	SRI International	456	938	48.6	IEEE	456	48.6	ACM-Assoc Comput Mach	71	7.6

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Software</i>										
1	Microsoft Corporation	28285	81677	34.6	IEEE	28285	34.6	ACM-Assoc Comput Mach	22999	28.2
2	Apple Inc	16627	37291	44.6	IEEE	16627	44.6	ACM-Assoc Comput Mach	8469	22.7
3	International Business Machi	15803	51568	30.6	IEEE	15803	30.6	ACM-Assoc Comput Mach	11914	23.1
4	Google Inc.	8442	23754	35.5	IEEE	8442	35.5	ACM-Assoc Comput Mach	6373	26.8
5	Oracle Corporation	4201	16132	26.0	ACM-Assoc Comput Mach	5434	33.7	IEEE	4201	26.0
6	Xperi Corporation (Formerly	3468	5690	60.9	IEEE	3468	60.9	ACM-Assoc Comput Mach	439	7.7
7	Siemens Aktiengesellschaft	3287	7936	41.4	IEEE	3287	41.4	SPIE-Int Soc Opt Engineering	921	11.6
8	Qualcomm Inc	3254	6393	50.9	IEEE	3254	50.9	ACM-Assoc Comput Mach	357	5.6
9	Intel Corporation	3132	6876	45.5	IEEE	3132	45.5	ACM-Assoc Comput Mach	1343	19.5
10	Adobe Inc.	2781	6699	41.5	IEEE	2781	41.5	ACM-Assoc Comput Mach	2234	33.3
11	AT&T Inc	2598	6267	41.5	IEEE	2598	41.5	ACM-Assoc Comput Mach	872	13.9
12	Xerox Corp	2564	7474	34.3	IEEE	2564	34.3	ACM-Assoc Comput Mach	1603	21.4
13	HP Inc	2482	6593	37.6	IEEE	2482	37.6	ACM-Assoc Comput Mach	1403	21.3
14	Cisco Systems Inc.	2396	7454	32.1	IEEE	2396	32.1	ACM-Assoc Comput Mach	1459	19.6
15	Nokia Corp	2274	5573	40.8	IEEE	2274	40.8	ACM-Assoc Comput Mach	577	10.4
16	Dolby Laboratories Inc	2249	3982	56.5	IEEE	2249	56.5	Audio Eng Soc	636	16.0
17	Ricoh Co. Ltd.	2220	4718	47.1	IEEE	2220	47.1	ACM-Assoc Comput Mach	781	16.6
18	Koninklijke Philips N.V.	2035	6184	32.9	IEEE	2035	32.9	RELX Group (Elsevier)	640	10.3
19	Broadcom Ltd	2029	4181	48.5	IEEE	2029	48.5	Joint IEEE and ACM	418	10.0
20	Sap SE	1982	9471	20.9	ACM-Assoc Comput Mach	3444	36.4	IEEE	1982	20.9
21	Amazon.com Inc.	1837	7390	24.9	ACM-Assoc Comput Mach	2107	28.5	IEEE	1837	24.9
22	Cadence Design Systems Inc	1825	3784	48.2	IEEE	1825	48.2	Joint IEEE and ACM	1070	28.3
23	Digimarc Corp.	1788	4402	40.6	IEEE	1788	40.6	SPIE-Int Soc Opt Engineering	599	13.6
24	Sony Corp	1728	3556	48.6	IEEE	1728	48.6	ACM-Assoc Comput Mach	582	16.4
25	Cognex Corp.	1670	3787	44.1	IEEE	1670	44.1	RELX Group (Elsevier)	701	18.5
26	Synopsys Inc.	1653	5408	30.6	IEEE	1653	30.6	SPIE-Int Soc Opt Engineering	1275	23.6
27	Nuance Communications Inc	1619	3667	44.2	IEEE	1619	44.2	ACM-Assoc Comput Mach	407	11.1
28	Commvault Systems Inc.	1506	2262	66.6	IEEE	1506	66.6	ACM-Assoc Comput Mach	354	15.6
29	General Electric Company	1504	3329	45.2	IEEE	1504	45.2	RELX Group (Elsevier)	308	9.3
30	Irobot Corp	1463	2510	58.3	IEEE	1463	58.3	SPIE-Int Soc Opt Engineering	375	14.9
31	Verizon Communications Inc	1399	7186	19.5	ACM-Assoc Comput Mach	1762	24.5	IEEE	1399	19.5
32	NEC Corp	1372	3120	44.0	IEEE	1372	44.0	ACM-Assoc Comput Mach	417	13.4
33	Honeywell International Inc.	1288	2383	54.0	IEEE	1288	54.0	RELX Group (Elsevier)	190	8.0
34	Applied Materials Inc.	1283	2202	58.3	IEEE	1283	58.3	American Institute of Physics	128	5.8
35	Accenture Ltd.	1272	3797	33.5	IEEE	1272	33.5	ACM-Assoc Comput Mach	607	16.0
36	Magna International Inc.	1268	2009	63.1	IEEE	1268	63.1	SAE-Society of Automobile Engineers	107	5.3
37	HRL Laboratories LLC	1266	2569	49.3	IEEE	1266	49.3	RELX Group (Elsevier)	229	8.9
38	Xilinx Inc.	1203	5182	23.2	ACM-Assoc Comput Mach	2595	50.1	IEEE	1203	23.2
39	Blackberry Ltd.	1189	3194	37.2	IEEE	1189	37.2	ACM-Assoc Comput Mach	299	9.4

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	PHOENIX SOLUTIONS INC	1070	3182	33.6	IEEE	1070	33.6	ISCA (International Speech Communication Association)	422	13.3
41	Honda Motor Co. Ltd.	956	1982	48.2	IEEE	956	48.2	RELX Group (Elsevier)	225	11.4
42	Intuitive Surgical Inc.	945	1448	65.3	IEEE	945	65.3	SAGES-Society of American Gastrointestinal and Endoscopic	71	4.9
43	MicroUnity Systems Enginee	941	1523	61.8	IEEE	941	61.8	Joint IEEE and ACM	140	9.2
44	Walt Disney Co.	927	3737	24.8	ACM-Assoc Comput Mach	2026	54.2	IEEE	927	24.8
45	NVIDIA Corp.	926	3233	28.6	ACM-Assoc Comput Mach	1248	38.6	IEEE	926	28.6
46	Raytheon Co.	917	1937	47.3	IEEE	917	47.3	SPIE-Int Soc Opt Engineering	155	8.0
47	Ericsson	911	2792	32.6	IEEE	911	32.6	3GPP General Partnership Project Standards Body	366	13.1
48	Samsung Electronics Co Ltd	909	1991	45.7	IEEE	909	45.7	ACM-Assoc Comput Mach	193	9.7
49	Canon Inc	907	2114	42.9	IEEE	907	42.9	ACM-Assoc Comput Mach	203	9.6
50	STMicroelectronics	884	1399	63.2	IEEE	884	63.2	RELX Group (Elsevier)	74	5.3
51	eBay Inc	871	4578	19.0	IEEE	871	19.0	ACM-Assoc Comput Mach	612	13.4
52	LG Electronics Inc.	862	1875	46.0	IEEE	862	46.0	Audio Eng Soc	139	7.4
53	Dell Technologies Inc	856	3368	25.4	ACM-Assoc Comput Mach	1199	35.6	IEEE	856	25.4
54	Facebook Inc	852	3182	26.8	ACM-Assoc Comput Mach	953	29.9	IEEE	852	26.8
55	Panasonic Corporation	825	1656	49.8	IEEE	825	49.8	ACM-Assoc Comput Mach	115	6.9
56	ParkerVision Inc	792	1713	46.2	IEEE	792	46.2	IET/IEE	491	28.7
57	Mitsubishi Electric Corp	786	1645	47.8	IEEE	786	47.8	ACM-Assoc Comput Mach	351	21.3
58	Boeing Co. (The)	725	2065	35.1	IEEE	725	35.1	RELX Group (Elsevier)	260	12.6
59	Motorola Solutions Inc.	723	1086	66.6	IEEE	723	66.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	37	3.4
60	Pelican Imaging Corporation	708	1531	46.2	IEEE	708	46.2	SPIE-Int Soc Opt Engineering	266	17.4
61	Fraunhofer Gesellschaft	691	1460	47.3	IEEE	691	47.3	Audio Eng Soc	141	9.7
62	Massachusetts Institute of Te	691	2520	27.4	IEEE	691	27.4	ACM-Assoc Comput Mach	260	10.3
63	Columbia University	688	1996	34.5	IEEE	688	34.5	ACM-Assoc Comput Mach	342	17.1
64	Fujitsu Limited	688	1816	37.9	IEEE	688	37.9	Joint IEEE and ACM	336	18.5
65	Hewlett Packard Enterprises	659	2102	31.4	IEEE	659	31.4	ACM-Assoc Comput Mach	628	29.9
66	Tela Innovations inc	657	2040	32.2	SPIE-Int Soc Opt Engineering	697	34.2	IEEE	657	32.2
67	Hon Hai Precision Industry C	643	1394	46.1	IEEE	643	46.1	ACM-Assoc Comput Mach	137	9.8
68	BT Group PLC	640	1360	47.1	IEEE	640	47.1	ACM-Assoc Comput Mach	124	9.1
69	University of California	640	4309	14.9	IEEE	640	14.9	RELX Group (Elsevier)	528	12.3
70	Technicolor SA	636	1266	50.2	IEEE	636	50.2	SPIE-Int Soc Opt Engineering	112	8.8
71	CenturyLink Inc	631	2477	25.5	ACM-Assoc Comput Mach	684	27.6	IEEE	631	25.5
72	Texas Instruments Inc	616	905	68.1	IEEE	616	68.1	Joint IEEE and ACM	48	5.3
73	Eastman Kodak Company	607	1382	43.9	IEEE	607	43.9	RELX Group (Elsevier)	134	9.7
74	Citrix Systems Inc	563	1796	31.3	IEEE	563	31.3	ACM-Assoc Comput Mach	316	17.6
75	Lockheed Martin Corp.	560	1194	46.9	IEEE	560	46.9	RELX Group (Elsevier)	117	9.8
76	Seiko Epson Corporation	559	1104	50.6	IEEE	559	50.6	Joint IEEE and ACM	129	11.7
77	Battelle Memorial Institute	552	787	70.1	IEEE	552	70.1	RELX Group (Elsevier)	65	8.3
78	Advanced Micro Devices Inc	538	1287	41.8	IEEE	538	41.8	ACM-Assoc Comput Mach	261	20.3
79	Intellectual Ventures Manage	528	1239	42.6	IEEE	528	42.6	ACM-Assoc Comput Mach	183	14.8
80	Sonos Inc	520	1203	43.2	IEEE	520	43.2	SPIE-Int Soc Opt Engineering	162	13.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Hitachi Ltd	509	2304	22.1	IEEE	509	22.1	ACM-Assoc Comput Mach	384	16.7
82	NOMADIX INC	500	1955	25.6	IEEE	500	25.6	Network Working Group RFC	307	15.7
83	INDIVIDUAL PATENTER	496	2186	22.7	IEEE	496	22.7	ACM-Assoc Comput Mach	339	15.5
84	United States Navy	496	1005	49.4	IEEE	496	49.4	RELX Group (Elsevier)	75	7.5
85	Cortica Ltd	488	656	74.4	IEEE	488	74.4	ACM-Assoc Comput Mach	69	10.5
86	Math Works Inc (The)	487	1059	46.0	IEEE	487	46.0	ACM-Assoc Comput Mach	195	18.4
87	Huawei Technologies Compa	484	1446	33.5	IEEE	484	33.5	Internet Soc/IETF-Internet Eng Task Force	152	10.5
88	Toshiba Corp	484	1109	43.6	IEEE	484	43.6	ACM-Assoc Comput Mach	93	8.4
89	Georgia Institute of Technolo	471	661	71.3	IEEE	471	71.3	ACM-Assoc Comput Mach	45	6.8
90	Bosch (Robert) GmbH	464	3464	13.4	IEEE	464	13.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	355	10.2
91	Marvell Technology Group Lt	464	636	73.0	IEEE	464	73.0	ACM-Assoc Comput Mach	37	5.8
92	TiVo Corp	460	1555	29.6	IEEE	460	29.6	ACM-Assoc Comput Mach	246	15.8
93	L3 Harris Technologies (form	458	794	57.7	IEEE	458	57.7	Internet Soc/IETF-Internet Eng Task Force	74	9.3
94	State University of New York	439	945	46.5	IEEE	439	46.5	ACM-Assoc Comput Mach	141	14.9
95	INTOUCH HEALTH INC	419	869	48.2	IEEE	419	48.2	IEEE/RSJ	42	4.8
96	JPMorgan	412	4530	9.1	Source Media	950	21.0	ACS-Am Chem Soc	419	9.2
97	University of North Carolina	405	1087	37.3	IEEE	405	37.3	ACM-Assoc Comput Mach	150	13.8
98	RPX Corp	401	1316	30.5	IEEE	401	30.5	Internet Soc/IETF-Internet Eng Task Force	174	13.2
99	VirnetX Holding Corp	400	6025	6.6	Network Working Group RFC	2794	46.4	Internet Soc/IETF-Internet Eng Task Force	1180	19.6
100	Netapp Inc	399	3066	13.0	ACM-Assoc Comput Mach	1464	47.7	The USENIX Association	535	17.4

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Cybersecurity</i>										
1	Microsoft Corporation	6122	21239	28.8	IEEE	6122	28.8	ACM-Assoc Comput Mach	5279	24.9
2	International Business Machi	4579	17185	26.6	IEEE	4579	26.6	ACM-Assoc Comput Mach	3926	22.8
3	Cisco Systems Inc.	3011	10047	30.0	IEEE	3011	30.0	ACM-Assoc Comput Mach	1608	16.0
4	Intel Corporation	1787	4390	40.7	IEEE	1787	40.7	ACM-Assoc Comput Mach	487	11.1
5	Blackberry Ltd.	1768	6228	28.4	IEEE	1768	28.4	Internet Soc/IETF-Internet Eng Task Force	648	10.4
6	Google Inc.	1697	5324	31.9	IEEE	1697	31.9	ACM-Assoc Comput Mach	1126	21.1
7	Oracle Corporation	1492	6471	23.1	IEEE	1492	23.1	ACM-Assoc Comput Mach	1464	22.6
8	Intertrust Technologies Corp	1425	9155	15.6	ACM-Assoc Comput Mach	1663	18.2	IEEE	1425	15.6
9	Columbia University	1272	4500	28.3	IEEE	1272	28.3	ACM-Assoc Comput Mach	982	21.8
10	FireEye Inc	1254	3248	38.6	IEEE	1254	38.6	ACM-Assoc Comput Mach	655	20.2
11	Wisteria Trading Inc	1241	2471	50.2	IEEE	1241	50.2	SPIE-Int Soc Opt Engineering	278	11.3
12	AT&T Inc	1204	3141	38.3	IEEE	1204	38.3	ACM-Assoc Comput Mach	394	12.5
13	Apple Inc	1105	2717	40.7	IEEE	1105	40.7	ACM-Assoc Comput Mach	563	20.7
14	Massachusetts Institute of Te	1083	1550	69.9	IEEE	1083	69.9	ACM-Assoc Comput Mach	190	12.3
15	McAfee Inc	1032	3944	26.2	IEEE	1032	26.2	ACM-Assoc Comput Mach	828	21.0
16	Nokia Corp	1018	4319	23.6	IEEE	1018	23.6	3GPP General Partnership Project Standards Body	966	22.4
17	Verizon Communications Inc	929	3666	25.3	IEEE	929	25.3	Internet Soc/IETF-Internet Eng Task Force	653	17.8
18	Citrix Systems Inc	915	2636	34.7	IEEE	915	34.7	ACM-Assoc Comput Mach	317	12.0
19	Qualcomm Inc	857	3308	25.9	3GPP General Partnership Project Standards B	868	26.2	IEEE	857	25.9
20	Digimarc Corp.	816	2151	37.9	IEEE	816	37.9	SPIE-Int Soc Opt Engineering	192	8.9
21	X ONE INC	789	1887	41.8	IEEE	789	41.8	ACM-Assoc Comput Mach	365	19.3
22	InterDigital Inc	745	3252	22.9	3GPP General Partnership Project Standards B	2164	66.5	IEEE	745	22.9
23	Amazon.com Inc.	736	2640	27.9	IEEE	736	27.9	ACM-Assoc Comput Mach	470	17.8
24	Symantec Corp.	717	2527	28.4	IEEE	717	28.4	ACM-Assoc Comput Mach	546	21.6
25	Broadcom Ltd	709	1993	35.6	IEEE	709	35.6	Network Working Group RFC	272	13.6
26	Dell Technologies Inc	686	2805	24.5	ACM-Assoc Comput Mach	858	30.6	IEEE	686	24.5
27	Juniper Networks Inc.	667	1409	47.3	IEEE	667	47.3	Internet Soc/IETF-Internet Eng Task Force	268	19.0
28	Ericsson	638	3600	17.7	3GPP General Partnership Project Standards B	1092	30.3	IEEE	638	17.7
29	Marvell Technology Group Lt	624	914	68.3	IEEE	624	68.3	ACM-Assoc Comput Mach	63	6.9
30	Xerox Corp	596	1540	38.7	IEEE	596	38.7	ACM-Assoc Comput Mach	547	35.5
31	NOMADIX INC	583	2217	26.3	IEEE	583	26.3	Network Working Group RFC	354	16.0
32	Sony Corp	583	1555	37.5	IEEE	583	37.5	ACM-Assoc Comput Mach	174	11.2
33	Verance Corp	578	1087	53.2	IEEE	578	53.2	SPIE-Int Soc Opt Engineering	137	12.6
34	Raytheon Co.	537	1700	31.6	IEEE	537	31.6	ACM-Assoc Comput Mach	229	13.5
35	IP RESERVOIR LLC	527	932	56.5	IEEE	527	56.5	ACM-Assoc Comput Mach	147	15.8
36	VirnetX Holding Corp	527	9087	5.8	Network Working Group RFC	4570	50.3	Internet Soc/IETF-Internet Eng Task Force	1540	16.9
37	HP Inc	525	2094	25.1	IEEE	525	25.1	Internet Soc/IETF-Internet Eng Task Force	358	17.1
38	Extreme Networks Inc	511	1108	46.1	IEEE	511	46.1	ACM-Assoc Comput Mach	136	12.3
39	Huawei Technologies Compa	487	2547	19.1	3GPP General Partnership Project Standards B	788	30.9	IEEE	487	19.1

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Headwater Partners 1 LLC	466	1029	45.3	IEEE	466	45.3	ACM-Assoc Comput Mach	216	21.0
41	Samsung Electronics Co Ltd	431	1208	35.7	IEEE	431	35.7	3GPP General Partnership Project Standards Body	268	22.2
42	L3 Harris Technologies (form	416	703	59.2	IEEE	416	59.2	RELX Group (Elsevier)	54	7.7
43	Fortinet Inc	396	753	52.6	IEEE	396	52.6	ACM-Assoc Comput Mach	144	19.1
44	Commvault Systems Inc.	393	609	64.5	IEEE	393	64.5	ACM-Assoc Comput Mach	100	16.4
45	Assa Abloy AB	368	1947	18.9	International Association for Cryptologic Rese	372	19.1	IEEE	368	18.9
46	Ricoh Co. Ltd.	362	928	39.0	IEEE	362	39.0	ACM-Assoc Comput Mach	208	22.4
47	Security First Corp	342	1071	31.9	IEEE	342	31.9	ACM-Assoc Comput Mach	317	29.6
48	DAMBALA INC	328	1203	27.3	IEEE	328	27.3	ACM-Assoc Comput Mach	314	26.1
49	ONETRUST LLC	314	1166	26.9	ACM-Assoc Comput Mach	714	61.2	IEEE	314	26.9
50	Motorola Solutions Inc.	304	647	47.0	IEEE	304	47.0	Network Working Group RFC	60	9.3
51	Arizona State University	296	679	43.6	IEEE	296	43.6	ACM-Assoc Comput Mach	208	30.6
52	LG Electronics Inc.	296	1098	27.0	3GPP General Partnership Project Standards B	475	43.3	IEEE	296	27.0
53	Silverbrook Pty Ltd	293	564	52.0	IEEE	293	52.0	RELX Group (Elsevier)	150	26.6
54	Fujitsu Limited	285	891	32.0	IEEE	285	32.0	ACM-Assoc Comput Mach	114	12.8
55	Toshiba Corp	281	1393	20.2	AACS-Advanced Access Content System	299	21.5	IEEE	281	20.2
56	ConvergeOne Inc	275	862	31.9	IEEE	275	31.9	ACM-Assoc Comput Mach	177	20.5
57	Sap SE	266	1021	26.1	ACM-Assoc Comput Mach	335	32.8	IEEE	266	26.1
58	Duchossois Group Inc	262	761	34.4	IEEE	262	34.4	International Association for Cryptologic Research (IACR)	120	15.8
59	Xilinx Inc.	255	1257	20.3	ACM-Assoc Comput Mach	628	50.0	IEEE	255	20.3
60	NEC Corp	252	1319	19.1	3GPP General Partnership Project Standards B	381	28.9	IEEE	252	19.1
61	Softbank Corp	252	713	35.3	IEEE	252	35.3	ACM-Assoc Comput Mach	79	11.1
62	NXP Semiconductors NV	251	420	59.8	IEEE	251	59.8	ACM-Assoc Comput Mach	31	7.4
63	Rambus Inc.	245	827	29.6	IEEE	245	29.6	International Association for Cryptologic Research (IACR)	215	26.0
64	BLUERISC INC	241	655	36.8	IEEE	241	36.8	ACM-Assoc Comput Mach	151	23.1
65	CONVERGENT MEDIA SO	240	954	25.2	ACM-Assoc Comput Mach	257	26.9	IEEE	240	25.2
66	Nippon Telegraph & Telepho	231	1661	13.9	International Association for Cryptologic Rese	383	23.1	IEEE	231	13.9
67	BLACK HILLS MEDIA LLC	228	870	26.2	Open Connectivity Foundation	412	47.4	IEEE	228	26.2
68	Commscope Inc.	228	434	52.5	IEEE	228	52.5	3GPP General Partnership Project Standards Body	45	10.4
69	NXGEN PARTNERS IP LLC	226	350	64.6	IEEE	226	64.6	Optical Society of America	64	18.3
70	Panasonic Corporation	220	896	24.6	IEEE	220	24.6	Internet Soc/IETF-Internet Eng Task Force	143	16.0
71	CENTRIPETAL NETWORK	215	483	44.5	IEEE	215	44.5	ACM-Assoc Comput Mach	104	21.5
72	Comcast Corp	201	437	46.0	IEEE	201	46.0	3GPP General Partnership Project Standards Body	152	34.8
73	Quest Software Inc	201	421	47.7	IEEE	201	47.7	ACM-Assoc Comput Mach	88	20.9
74	Western Digital Corp.	201	646	31.1	IEEE	201	31.1	ACM-Assoc Comput Mach	71	11.0
75	Facebook Inc	198	810	24.4	ACM-Assoc Comput Mach	246	30.4	IEEE	198	24.4
76	West Corp	195	408	47.8	IEEE	195	47.8	Springer/Sp. Wien/Springer-Verlag/KluwAcad	48	11.8
77	PRISM TECHNOLOGIES L	190	1053	18.0	IEEE	190	18.0	Internet Soc/IETF-Internet Eng Task Force	183	17.4
78	RPX Corp	190	760	25.0	Internet Soc/IETF-Internet Eng Task Force	208	27.4	IEEE	190	25.0
79	JPMorgan	184	957	19.2	IEEE	184	19.2	Source Media	87	9.1
80	Electronics and Telecommuni	183	391	46.8	IEEE	183	46.8	ACM-Assoc Comput Mach	35	9.0

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	TRILLIANT NETWORKS IN	183	274	66.8	IEEE	183	66.8	Internet Soc/IETF-Internet Eng Task Force	17	6.2
82	Siemens Aktiengesellschaft	181	587	30.8	IEEE	181	30.8	Internet Soc/IETF-Internet Eng Task Force	84	14.3
83	ODYSSEY WIRELESS INC	180	207	87.0	IEEE	180	87.0	3GPP General Partnership Project Standards Body	5	2.4
84	HEADWATER RESEARCH	179	306	58.5	IEEE	179	58.5	ACM-Assoc Comput Mach	68	22.2
85	Witricity Corp	176	246	71.5	IEEE	176	71.5	American Institute of Physics	15	6.1
86	Adobe Inc.	174	431	40.4	IEEE	174	40.4	ACM-Assoc Comput Mach	71	16.5
87	Canon Inc	173	461	37.5	IEEE	173	37.5	ACM-Assoc Comput Mach	51	11.1
88	Lockheed Martin Corp.	173	325	53.2	IEEE	173	53.2	ACM-Assoc Comput Mach	21	6.5
89	Via Technologies Inc.	173	300	57.7	IEEE	173	57.7	Joint IEEE and ACM	34	11.3
90	Accenture Ltd.	169	480	35.2	IEEE	169	35.2	ACM-Assoc Comput Mach	156	32.5
91	ARC DEVICES LTD	168	623	27.0	ACM-Assoc Comput Mach	284	45.6	IEEE	168	27.0
92	Adidas AG	166	195	85.1	IEEE	166	85.1	RELX Group (Elsevier)	9	4.6
93	EICES RESEARCH INC	166	276	60.1	IEEE	166	60.1	3GPP General Partnership Project Standards Body	30	10.9
94	Micro Focus International PL	166	541	30.7	IEEE	166	30.7	Internet Soc/IETF-Internet Eng Task Force	68	12.6
95	VerintSys	166	898	18.5	ACM-Assoc Comput Mach	211	23.5	International Data Group	198	22.0
96	A10 Networks Inc	164	304	53.9	IEEE	164	53.9	ACM-Assoc Comput Mach	59	19.4
97	Global Tel Link Corp	164	257	63.8	IEEE	164	63.8	RELX Group (Elsevier)	14	5.4
98	WEST VIEW RESEARCH L	162	353	45.9	IEEE	162	45.9	SAE-Society of Automobile Engineers	36	10.2
99	UNIVERSIDADE DO PORT	160	195	82.1	IEEE	160	82.1	ACM-Assoc Comput Mach	21	10.8
100	Netapp Inc	156	751	20.8	The USENIX Association	164	21.8	ACM-Assoc Comput Mach	159	21.2

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Diagnosis/Surgery/Medical Instruments</i>										
1	Medtronic Inc	10503	1E+05	8.3	RELX Group (Elsevier)	21513	17.0	Lippincott Williams & Wilkins Ltd.	15859	12.5
2	Boston Scientific Corp.	5054	74887	6.7	RELX Group (Elsevier)	20576	27.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	9187	12.3
3	Dexcom Inc	4299	65103	6.6	RELX Group (Elsevier)	16523	25.4	American Diabetes Association	6796	10.4
4	Intuitive Surgical Inc.	3762	7549	49.8	IEEE	3762	49.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	498	6.6
5	Abbott Laboratories	3684	77738	4.7	RELX Group (Elsevier)	18948	24.4	ACS-Am Chem Soc	7598	9.8
6	Johnson & Johnson	2684	44962	6.0	RELX Group (Elsevier)	8950	19.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4699	10.5
7	Partners HealthCare Systems	2050	23843	8.6	Optical Society of America	6314	26.5	RELX Group (Elsevier)	3598	15.1
8	The Invention Science Fund 1	1599	10775	14.8	IEEE	1599	14.8	RELX Group (Elsevier)	1267	11.8
9	Massachusetts Institute of Te	1575	6033	26.1	IEEE	1575	26.1	RELX Group (Elsevier)	1239	20.5
10	Koninklijke Philips N.V.	1567	10170	15.4	IEEE	1567	15.4	RELX Group (Elsevier)	1334	13.1
11	Siemens Aktiengesellschaft	1365	4717	28.9	IEEE	1365	28.9	RELX Group (Elsevier)	569	12.1
12	Stryker Corp.	1151	7595	15.2	RELX Group (Elsevier)	1342	17.7	IEEE	1151	15.2
13	GUIDED THERAPY SYSTE	1084	2787	38.9	IEEE	1084	38.9	RELX Group (Elsevier)	387	13.9
14	Smith & Nephew Plc.	997	14763	6.8	RELX Group (Elsevier)	2996	20.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1460	9.9
15	General Electric Company	988	4960	19.9	IEEE	988	19.9	RELX Group (Elsevier)	719	14.5
16	LivaNova Plc	924	12708	7.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2658	20.9	RELX Group (Elsevier)	2520	19.8
17	Masimo Corp	923	2243	41.2	IEEE	923	41.2	Lippincott Williams & Wilkins Ltd.	207	9.2
18	University of California	852	7736	11.0	RELX Group (Elsevier)	1535	19.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	873	11.3
19	Vanderbilt University	792	2361	33.5	IEEE	792	33.5	RELX Group (Elsevier)	332	14.1
20	VIVAQUANT LLC	785	1244	63.1	IEEE	785	63.1	RELX Group (Elsevier)	102	8.2
21	Otto Bock Holding GmbH &	770	1515	50.8	IEEE	770	50.8	RELX Group (Elsevier)	219	14.5
22	Stanford University	699	10980	6.4	RELX Group (Elsevier)	1792	16.3	MacMillan Publishing Company	978	8.9
23	Columbia University	671	2428	27.6	IEEE	671	27.6	RELX Group (Elsevier)	493	20.3
24	University of Nebraska	594	2056	28.9	IEEE	594	28.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	298	14.5
25	Sotera Wireless	591	1092	54.1	IEEE	591	54.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	175	16.0
26	Google Inc.	580	1260	46.0	IEEE	580	46.0	RELX Group (Elsevier)	131	10.4
27	Ossur hf	518	1352	38.3	IEEE	518	38.3	RELX Group (Elsevier)	266	19.7
28	Cleveland Clinic (and Founda	484	2849	17.0	RELX Group (Elsevier)	593	20.8	IEEE	484	17.0
29	University of Illinois	484	5287	9.2	American Institute of Physics	803	15.2	ACS-Am Chem Soc	710	13.4
30	BUTTERFLY NETWORKS I	480	541	88.7	IEEE	480	88.7	Acoustical Society of America	28	5.2
31	MIRAMAR LABS INC	472	1122	42.1	IEEE	472	42.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	125	11.1
32	University of Michigan	429	4723	9.1	RELX Group (Elsevier)	1209	25.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	442	9.4
33	Maui Diagnostic Imaging	428	531	80.6	IEEE	428	80.6	RELX Group (Elsevier)	33	6.2
34	Johns Hopkins University	415	2230	18.6	IEEE	415	18.6	RELX Group (Elsevier)	354	15.9
35	Mevion Medical Systems Inc	396	1063	37.3	IEEE	396	37.3	RELX Group (Elsevier)	162	15.2
36	Valencell Inc	393	736	53.4	IEEE	393	53.4	RELX Group (Elsevier)	42	5.7
37	University of Texas	386	5274	7.3	RELX Group (Elsevier)	995	18.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	612	11.6
38	IWALK INC	385	1024	37.6	IEEE	385	37.6	RELX Group (Elsevier)	207	20.2
39	BIO CONTROL MEDICAL (383	1409	27.2	IEEE	383	27.2	Lippincott Williams & Wilkins Ltd.	221	15.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Bonutti Technologies LLC	343	1863	18.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	425	22.8	IEEE	343	18.4
41	Virginia Tech University	342	1412	24.2	IEEE	342	24.2	RELX Group (Elsevier)	259	18.3
42	HIGHLAND INSTRUMENT	338	556	60.8	IEEE	338	60.8	RELX Group (Elsevier)	43	7.7
43	University of Washington	331	3149	10.5	RELX Group (Elsevier)	602	19.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	368	11.7
44	University Health Network	322	733	43.9	IEEE	322	43.9	RELX Group (Elsevier)	99	13.5
45	University of Minnesota (The	322	2045	15.7	RELX Group (Elsevier)	435	21.3	IEEE	322	15.7
46	Becton Dickinson and Co.	309	20678	1.5	RELX Group (Elsevier)	3511	17.0	Wolters Kluwer	3224	15.6
47	California Institute of Techno	307	1931	15.9	RELX Group (Elsevier)	326	16.9	IEEE	307	15.9
48	Nyxoah SA	304	638	47.6	IEEE	304	47.6	RELX Group (Elsevier)	70	11.0
49	BIOSENSORS INTERNATI	302	973	31.0	IEEE	302	31.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	141	14.5
50	Nevro Corp	291	2009	14.5	Lippincott Williams & Wilkins Ltd.	424	21.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	332	16.5
51	Cirrus Logic Inc.	290	407	71.3	IEEE	290	71.3	Acoustical Society of America	40	9.8
52	Elwha LLC	289	1284	22.5	IEEE	289	22.5	RELX Group (Elsevier)	124	9.7
53	University of Pennsylvania	287	4450	6.4	RELX Group (Elsevier)	678	15.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	552	12.4
54	KONA MEDICAL INC	281	1806	15.6	RELX Group (Elsevier)	476	26.4	IEEE	281	15.6
55	Concormis Inc	279	8013	3.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1342	16.7	RELX Group (Elsevier)	996	12.4
56	Medispectra Inc	279	753	37.1	IEEE	279	37.1	RELX Group (Elsevier)	83	11.0
57	Proteus Biomedical Inc	276	1135	24.3	IEEE	276	24.3	RELX Group (Elsevier)	207	18.2
58	Bardy Diagnostics Inc	268	452	59.3	IEEE	268	59.3	RELX Group (Elsevier)	65	14.4
59	FACENSE LTD	268	319	84.0	IEEE	268	84.0	ACM-Assoc Comput Mach	35	11.0
60	University of Pittsburgh	266	2698	9.9	RELX Group (Elsevier)	684	25.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	314	11.6
61	University of Florida	265	1328	20.0	IEEE	265	20.0	RELX Group (Elsevier)	240	18.1
62	AngioDynamics Inc.	259	2801	9.2	RELX Group (Elsevier)	625	22.3	IEEE	259	9.2
63	BRAINGATE CO LLC	254	675	37.6	IEEE	254	37.6	RELX Group (Elsevier)	101	15.0
64	INDIVIDUAL PATENTER	242	6495	3.7	RELX Group (Elsevier)	1447	22.3	Lippincott Williams & Wilkins Ltd.	737	11.3
65	Asahi Kasei Corp.	238	3395	7.0	Lippincott Williams & Wilkins Ltd.	848	25.0	RELX Group (Elsevier)	641	18.9
66	Alcon Inc	234	5367	4.4	RELX Group (Elsevier)	1546	28.8	American Medical Association	473	8.8
67	Samsung Electronics Co Ltd	229	449	51.0	IEEE	229	51.0	RELX Group (Elsevier)	45	10.0
68	HEMOSONICS LLC	220	426	51.6	IEEE	220	51.6	RELX Group (Elsevier)	45	10.6
69	Varian Medical Systems Inc.	209	2336	8.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	635	27.2	RELX Group (Elsevier)	540	23.1
70	Medrobtotics Corp	203	407	49.9	IEEE	203	49.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	76	18.7
71	Hologic Inc	197	3378	5.8	RELX Group (Elsevier)	716	21.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	588	17.4
72	Case Western Reserve Univer	190	627	30.3	IEEE	190	30.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	69	11.0
73	Victhom Human Bionics Inc	190	376	50.5	IEEE	190	50.5	RELX Group (Elsevier)	86	22.9
74	GEARBOX LLC	189	844	22.4	IEEE	189	22.4	RELX Group (Elsevier)	76	9.0
75	United States Department of	188	867	21.7	IEEE	188	21.7	RELX Group (Elsevier)	183	21.1
76	University of South Florida	186	902	20.6	RELX Group (Elsevier)	192	21.3	IEEE	186	20.6
77	Washington University in St.	183	2051	8.9	RELX Group (Elsevier)	296	14.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	279	13.6
78	BLUEWIND MEDICAL LT	178	273	65.2	IEEE	178	65.2	American Physiological Society	24	8.8
79	SRI International	175	315	55.6	IEEE	175	55.6	RELX Group (Elsevier)	25	7.9
80	Arizona State University	172	403	42.7	IEEE	172	42.7	RELX Group (Elsevier)	62	15.4

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Impulse Dynamics N.V.	171	2156	7.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	441	20.5	Lippincott Williams & Wilkins Ltd.	308	14.3
82	St. Louis University	171	1150	14.9	Lippincott Williams & Wilkins Ltd.	220	19.1	American Association of Neurological Surgeons	188	16.3
83	University of Virginia (and P	171	945	18.1	IEEE	171	18.1	RELX Group (Elsevier)	162	17.1
84	Canon Inc	168	1041	16.1	IEEE	168	16.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	131	12.6
85	Duke University	168	1539	10.9	RELX Group (Elsevier)	254	16.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	216	14.0
86	Lockheed Martin Corp.	168	1843	9.1	RELX Group (Elsevier)	214	11.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	199	10.8
87	Bayer AG	167	1645	10.2	RELX Group (Elsevier)	271	16.5	Lippincott Williams & Wilkins Ltd.	212	12.9
88	Hitachi Ltd	166	648	25.6	IEEE	166	25.6	American Institute of Physics	70	10.8
89	PHYSIOWAVE INC	166	266	62.4	IEEE	166	62.4	Lippincott Williams & Wilkins Ltd.	29	10.9
90	Electrocor Llc	157	667	23.5	IEEE	157	23.5	Natl Acad Sciences	116	17.4
91	Mayo Foundation for Medica	156	2581	6.0	RELX Group (Elsevier)	558	21.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	366	14.2
92	International Business Machi	154	377	40.8	IEEE	154	40.8	RELX Group (Elsevier)	31	8.2
93	CLINICAL DECISION SUPP	152	726	20.9	RELX Group (Elsevier)	159	21.9	IEEE	152	20.9
94	Northwestern University	152	2096	7.3	RELX Group (Elsevier)	381	18.2	American Institute of Physics	297	14.2
95	Georgia Institute of Technolo	150	1020	14.7	RELX Group (Elsevier)	191	18.7	IEEE	150	14.7
96	NEUROVISTA CORP	150	1171	12.8	RELX Group (Elsevier)	335	28.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	185	15.8
97	MC10 Inc	149	1330	11.2	American Institute of Physics	324	24.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	161	12.1
98	University of Wisconsin	149	1953	7.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	396	20.3	RELX Group (Elsevier)	223	11.4
99	Nuvasive Inc	147	6041	2.4	Lippincott Williams & Wilkins Ltd.	3110	51.5	RELX Group (Elsevier)	717	11.9
100	Sonova Holding AG	146	868	16.8	IEEE	146	16.8	RELX Group (Elsevier)	135	15.6

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Information Storage</i>										
1	Micron Technology Inc.	15346	31223	49.1	IEEE	15346	49.1	RELX Group (Elsevier)	4682	15.0
2	Western Digital Corp.	6090	11282	54.0	IEEE	6090	54.0	American Institute of Physics	1244	11.0
3	International Business Machi	4794	13320	36.0	IEEE	4794	36.0	ACM-Assoc Comput Mach	2349	17.6
4	ZENO SEMICONDUCTOR I	4194	5475	76.6	IEEE	4194	76.6	IEEE/JPN Soc App Phys	1008	18.4
5	Broadcom Ltd	2545	3152	80.7	IEEE	2545	80.7	ACM-Assoc Comput Mach	136	4.3
6	Macronix International Co. Lt	2468	4310	57.3	IEEE	2468	57.3	IEEE/JPN Soc App Phys	826	19.2
7	Semiconductor Energy Labor	2194	19482	11.3	SID-Society for Information Display	6291	32.3	American Institute of Physics	3111	16.0
8	Conversant Intellectual Prope	2181	2650	82.3	IEEE	2181	82.3	IEEE/JPN Soc App Phys	195	7.4
9	Rambus Inc.	2085	3440	60.6	IEEE	2085	60.6	JEDEC Semiconductor Standards Organization	269	7.8
10	Seagate Technology Plc	2001	5029	39.8	IEEE	2001	39.8	American Institute of Physics	1048	20.8
11	Toshiba Corp	1610	3510	45.9	IEEE	1610	45.9	American Institute of Physics	430	12.3
12	Innovative Silicon SA	1580	1959	80.7	IEEE	1580	80.7	RELX Group (Elsevier)	84	4.3
13	Intel Corporation	1449	3338	43.4	IEEE	1449	43.4	Joint IEEE and ACM	523	15.7
14	Apple Inc	1432	2902	49.3	IEEE	1432	49.3	American Institute of Physics	251	8.6
15	ATTOPSEMI TECHNOLOG	1201	1522	78.9	IEEE	1201	78.9	IEEE/JPN Soc App Phys	216	14.2
16	Texas Instruments Inc	1011	1377	73.4	IEEE	1011	73.4	United Business Media/UBM Tech	79	5.7
17	Cypress Semiconductor Corp.	982	1202	81.7	IEEE	982	81.7	American Institute of Physics	66	5.5
18	Hitachi Ltd	961	2318	41.5	IEEE	961	41.5	ACM-Assoc Comput Mach	193	8.3
19	Renesas Electronic Corporati	960	1302	73.7	IEEE	960	73.7	IEEE/JPN Soc App Phys	94	7.2
20	Oracle Corporation	820	2852	28.8	ACM-Assoc Comput Mach	1124	39.4	IEEE	820	28.8
21	Samsung Electronics Co Ltd	706	1949	36.2	IEEE	706	36.2	American Institute of Physics	205	10.5
22	Microsoft Corporation	680	3119	21.8	ACM-Assoc Comput Mach	1216	39.0	IEEE	680	21.8
23	Netapp Inc	654	2834	23.1	ACM-Assoc Comput Mach	1210	42.7	IEEE	654	23.1
24	TDK Corporation	653	1895	34.5	IEEE	653	34.5	American Institute of Physics	440	23.2
25	MONOLITHIC 3D INC	607	1070	56.7	IEEE	607	56.7	IEEE/JPN Soc App Phys	118	11.0
26	NXP Semiconductors NV	569	819	69.5	IEEE	569	69.5	Joint IEEE and ACM	68	8.3
27	Qualcomm Inc	540	876	61.6	IEEE	540	61.6	Joint IEEE and ACM	85	9.7
28	Commvault Systems Inc.	528	820	64.4	IEEE	528	64.4	ACM-Assoc Comput Mach	143	17.4
29	Dell Technologies Inc	511	1466	34.9	IEEE	511	34.9	ACM-Assoc Comput Mach	448	30.6
30	Marvell Technology Group Lt	490	660	74.2	IEEE	490	74.2	ECMA International	34	5.2
31	Synopsys Inc.	489	953	51.3	IEEE	489	51.3	American Institute of Physics	134	14.1
32	HP Inc	468	1502	31.2	IEEE	468	31.2	ACM-Assoc Comput Mach	274	18.2
33	Infineon Technologies AG	451	715	63.1	IEEE	451	63.1	IEEE/JPN Soc App Phys	72	10.1
34	Avid Technology Inc.	436	848	51.4	IEEE	436	51.4	ACM-Assoc Comput Mach	272	32.1
35	STMicroelectronics	433	649	66.7	IEEE	433	66.7	RELX Group (Elsevier)	38	5.9
36	Microchip Technology Inc.	430	545	78.9	IEEE	430	78.9	IEEE/JPN Soc App Phys	23	4.2
37	Fujitsu Limited	412	784	52.6	IEEE	412	52.6	American Institute of Physics	76	9.7
38	Boston Scientific Corp.	386	511	75.5	IEEE	386	75.5	IEEE/JPN Soc App Phys	52	10.2
39	Sony Corp	371	915	40.5	IEEE	371	40.5	American Institute of Physics	55	6.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Mitsubishi Electric Corp	338	616	54.9	IEEE	338	54.9	ECMA International	97	15.7
41	Intertrust Technologies Corp	315	1918	16.4	ACM-Assoc Comput Mach	387	20.2	IEEE	315	16.4
42	Massachusetts Institute of Te	301	527	57.1	IEEE	301	57.1	ACM-Assoc Comput Mach	53	10.1
43	Softbank Corp	299	546	54.8	IEEE	299	54.8	Joint IEEE and ACM	119	21.8
44	Taiwan Semiconductor Manu	292	399	73.2	IEEE	292	73.2	IEEE/JPN Soc App Phys	53	13.3
45	QST Holdings Llc	290	486	59.7	IEEE	290	59.7	Joint IEEE and ACM	56	11.5
46	Advanced Micro Devices Inc	283	834	33.9	IEEE	283	33.9	Joint IEEE and ACM	184	22.1
47	Crossbar Inc	274	1061	25.8	IEEE	274	25.8	American Institute of Physics	145	13.7
48	Densbits Technologies Ltd	271	502	54.0	IEEE	271	54.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	78	15.5
49	Panasonic Corporation	267	852	31.3	IEEE	267	31.3	Institute of Pure and Applied Physics	103	12.1
50	California Institute of Techno	265	396	66.9	IEEE	265	66.9	AAAS-Am Assoc Advancement Sci	18	4.5
51	Intellectual Ventures Manage	264	294	89.8	IEEE	264	89.8	ACM-Assoc Comput Mach	23	7.8
52	OVONYX MEMORY TECH	253	300	84.3	IEEE	253	84.3	IEEE/JPN Soc App Phys	19	6.3
53	Nantero Inc	250	2268	11.0	ACS-Am Chem Soc	580	25.6	American Institute of Physics	512	22.6
54	Netlist Inc	237	937	25.3	IP.Com	269	28.7	IEEE	237	25.3
55	ConvergeOne Inc	232	442	52.5	IEEE	232	52.5	Joint IEEE and ACM	95	21.5
56	NEC Corp	231	576	40.1	IEEE	231	40.1	American Institute of Physics	98	17.0
57	Cirrus Logic Inc.	223	266	83.8	IEEE	223	83.8	Institute of Business Administrtion (IBA) and IEEE	8	3.0
58	Google Inc.	221	537	41.2	IEEE	221	41.2	ACM-Assoc Comput Mach	180	33.5
59	SK Hynix Inc	209	321	65.1	IEEE	209	65.1	Joint IEEE and ACM	24	7.5
60	Xilinx Inc.	189	261	72.4	IEEE	189	72.4	Joint IEEE and ACM	27	10.3
61	Hon Hai Precision Industry C	187	448	41.7	IEEE	187	41.7	American Institute of Physics	61	13.6
62	Hewlett Packard Enterprises	172	459	37.5	IEEE	172	37.5	ACM-Assoc Comput Mach	128	27.9
63	Global Foundries Inc	158	272	58.1	IEEE	158	58.1	Joint IEEE and ACM	20	7.4
64	PACT XPP TECHNOLOGIE	158	274	57.7	IEEE	158	57.7	ACM-Assoc Comput Mach	24	8.8
65	Pioneer Corp.	150	593	25.3	SPIE-Int Soc Opt Engineering	219	36.9	IEEE	150	25.3
66	Avalanche Technology Inc	144	651	22.1	American Institute of Physics	202	31.0	IEEE	144	22.1
67	Mellanox Technologies Ltd	143	328	43.6	IEEE	143	43.6	Joint IEEE and ACM	108	32.9
68	Kandou	140	146	95.9	IEEE	140	95.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	1.4
69	Commissariat A L'Energie At	136	330	41.2	IEEE	136	41.2	American Institute of Physics	60	18.2
70	Arizona State University	134	238	56.3	IEEE	134	56.3	Joint IEEE and ACM	25	10.5
71	NVIDIA Corp.	134	265	50.6	IEEE	134	50.6	ACM-Assoc Comput Mach	42	15.8
72	INDIVIDUAL PATENTER	132	266	49.6	IEEE	132	49.6	RELX Group (Elsevier)	26	9.8
73	Cisco Systems Inc.	127	279	45.5	IEEE	127	45.5	ACM-Assoc Comput Mach	68	24.4
74	FireEye Inc	125	329	38.0	IEEE	125	38.0	ACM-Assoc Comput Mach	63	19.1
75	OPTICAL DEVICES LLC	122	220	55.5	IEEE	122	55.5	American Automatic Control Council (AACC)	30	13.6
76	Industrial Technology Researc	120	199	60.3	IEEE	120	60.3	IEEE/JPN Soc App Phys	18	9.0
77	Nokia Corp	117	306	38.2	IEEE	117	38.2	ACM-Assoc Comput Mach	59	19.3
78	University of California	117	523	22.4	ACS-Am Chem Soc	126	24.1	IEEE	117	22.4
79	Columbia University	115	303	38.0	IEEE	115	38.0	ACM-Assoc Comput Mach	52	17.2
80	Sap SE	112	370	30.3	IEEE	112	30.3	ACM-Assoc Comput Mach	68	18.4

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81	Soitec SA	111	140	79.3	IEEE	111	79.3	IET/IEEE	7	5.0
82	Round Rock Research LLC	109	480	22.7	RELX Group (Elsevier)	138	28.8	IEEE	109	22.7
83	Tela Innovations inc	101	289	34.9	IEEE	101	34.9	SPIE-Int Soc Opt Engineering	87	30.1
84	Integrated Device Technology	94	111	84.7	IEEE	94	84.7	PennWell Publishing Co.	6	5.4
85	Yonsei University	92	143	64.3	IEEE	92	64.3	Joint IEEE and ACM	16	11.2
86	Glassbridge Enterprises Inc	90	200	45.0	IEEE	90	45.0	RELX Group (Elsevier)	20	10.0
87	United Microelectronics Corp	90	159	56.6	IEEE	90	56.6	American Institute of Physics	30	18.9
88	Carnegie Mellon University	88	167	52.7	IEEE	88	52.7	American Institute of Physics	56	33.5
89	Interuniversity MicroElectron	85	148	57.4	IEEE	85	57.4	Joint IEEE and ACM	17	11.5
90	Texas A&M University	84	105	80.0	IEEE	84	80.0	Science Press	5	4.8
91	Waratek	83	220	37.7	IEEE	83	37.7	ACM-Assoc Comput Mach	55	25.0
92	Siemens Aktiengesellschaft	82	156	52.6	IEEE	82	52.6	American Institute of Physics	24	15.4
93	SPIN MEMORY INC	78	153	51.0	IEEE	78	51.0	American Institute of Physics	40	26.1
94	Amazon.com Inc.	76	199	38.2	IEEE	76	38.2	ACM-Assoc Comput Mach	51	25.6
95	Koninklijke Philips N.V.	76	196	38.8	IEEE	76	38.8	Institute of Pure and Applied Physics	13	6.6
96	McAfee Inc	71	206	34.5	IEEE	71	34.5	ACM-Assoc Comput Mach	58	28.2
97	Cadence Design Systems Inc	69	108	63.9	IEEE	69	63.9	Penton/IPC, Inc.	20	18.5
98	The Invention Science Fund 1	69	215	32.1	IEEE	69	32.1	Massachusetts Institute of Technology	38	17.7
99	Honeywell International Inc.	68	114	59.6	IEEE	68	59.6	RELX Group (Elsevier)	8	7.0
100	Huawei Technologies Compa	68	192	35.4	IEEE	68	35.4	Joint IEEE and ACM	53	27.6

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>IOT/Internet of Things</i>										
1	Apple Inc	2619	5507	47.6	IEEE	2619	47.6	ACM-Assoc Comput Mach	1364	24.8
2	Velatia Group	839	1099	76.3	IEEE	839	76.3	Echelon Corp	81	7.4
3	SolarEdge Technologies Inc	611	672	90.9	IEEE	611	90.9	WIP-Renewable Energies	20	3.0
4	SIPCO LLC	603	1022	59.0	IEEE	603	59.0	Internet Soc/IETF-Internet Eng Task Force	88	8.6
5	Honeywell International Inc.	298	377	79.0	IEEE	298	79.0	American Library Association	12	3.2
6	AT&T Inc	262	436	60.1	IEEE	262	60.1	RELX Group (Elsevier)	19	4.4
7	TRILLIANT NETWORKS IN	239	339	70.5	IEEE	239	70.5	Joint IEEE and ACM	19	5.6
8	ORIGIN WIRELESS INC	231	287	80.5	IEEE	231	80.5	Acoustical Society of America	10	3.5
9	Rockwell Automation Inc	227	381	59.6	IEEE	227	59.6	ACM-Assoc Comput Mach	59	15.5
10	LG Electronics Inc.	213	322	66.1	IEEE	213	66.1	3GPP General Partnership Project Standards Body	100	31.1
11	International Business Machi	188	395	47.6	IEEE	188	47.6	ACM-Assoc Comput Mach	27	6.8
12	General Electric Company	187	263	71.1	IEEE	187	71.1	IET/IEE	13	4.9
13	Cisco Systems Inc.	176	389	45.2	IEEE	176	45.2	ACM-Assoc Comput Mach	45	11.6
14	EAGLE HARBOR HOLDIN	171	443	38.6	IEEE	171	38.6	SAE-Society of Automobile Engineers	117	26.4
15	Microsoft Corporation	170	402	42.3	IEEE	170	42.3	ACM-Assoc Comput Mach	85	21.1
16	Schneider Electric S.A.	159	1353	11.8	ISA - Instrumentation, Systems & Automation	252	18.6	IEEE	159	11.8
17	Google Inc.	148	322	46.0	IEEE	148	46.0	ACM-Assoc Comput Mach	72	22.4
18	ABB Ltd	144	171	84.2	IEEE	144	84.2	IET/IEE	7	4.1
19	Sonos Inc	137	258	53.1	IEEE	137	53.1	ACM-Assoc Comput Mach	24	9.3
20	Samsung Electronics Co Ltd	128	804	15.9	3GPP General Partnership Project Standards B	562	69.9	IEEE	128	15.9
21	Qualcomm Inc	112	275	40.7	IEEE	112	40.7	3GPP General Partnership Project Standards Body	82	29.8
22	Comcast Corp	108	120	90.0	IEEE	108	90.0	SCTE - Society of Cable and Telecom Eng	8	6.7
23	Battelle Memorial Institute	107	147	72.8	IEEE	107	72.8	RELX Group (Elsevier)	8	5.4
24	California Institute of Techno	106	110	96.4	IEEE	106	96.4	American Automatic Control Council (AACC)	3	2.7
25	Intel Corporation	105	247	42.5	IEEE	105	42.5	3GPP General Partnership Project Standards Body	95	38.5
26	EchoStar Corp	81	96	84.4	IEEE	81	84.4	Rajagiri School of Engineering & Technology, Cochin, Kerala,	9	9.4
27	STATSIGNAL SYSTEMS IN	75	132	56.8	IEEE	75	56.8	Internet Soc/IETF-Internet Eng Task Force	14	10.6
28	Extreme Networks Inc	74	156	47.4	IEEE	74	47.4	ACM-Assoc Comput Mach	20	12.8
29	Adaptive Computing Enterpri	72	145	49.7	IEEE	72	49.7	ACM-Assoc Comput Mach	26	17.9
30	Alstom	69	81	85.2	IEEE	69	85.2	IET/IEE	8	9.9
31	BORGIA/CUMMINS LLC	69	102	67.6	IEEE	69	67.6	SPIE-Int Soc Opt Engineering	17	16.7
32	Nokia Corp	68	152	44.7	IEEE	68	44.7	3GPP General Partnership Project Standards Body	32	21.1
33	Toyota Motor Corp	66	188	35.1	IEEE	66	35.1	ACM-Assoc Comput Mach	51	27.1
34	AMPT LLC	63	68	92.6	IEEE	63	92.6	IET/IEE	4	5.9
35	Siemens Aktiengesellschaft	63	129	48.8	IEEE	63	48.8	United Business Media/UBM Tech	11	8.5
36	ASTROLINK INTERNATIO	59	67	88.1	IEEE	59	88.1	IET/IEE	6	9.0
37	DOMINION ENERGY TEC	59	67	88.1	IEEE	59	88.1	IET/IEE	6	9.0
38	Emerson Electric Co.	59	100	59.0	IEEE	59	59.0	RELX Group (Elsevier)	11	11.0
39	Sap SE	57	152	37.5	IEEE	57	37.5	ACM-Assoc Comput Mach	33	21.7

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40	WALMART APOLLO LLC	57	86	66.3	IEEE	57	66.3	IEEE/RSJ	9	10.5
41	SOLAREEDGE TECHNOLO	55	68	80.9	IEEE	55	80.9	WIP-Renewable Energies	7	10.3
42	Itron Inc.	54	93	58.1	IEEE	54	58.1	ACM-Assoc Comput Mach	11	11.8
43	Irobot Corp	53	89	59.6	IEEE	53	59.6	SPIE-Int Soc Opt Engineering	9	10.1
44	Western Digital Corp.	53	63	84.1	IEEE	53	84.1	RELX Group (Elsevier)	10	15.9
45	Deere & Co.	48	71	67.6	IEEE	48	67.6	DOW JONES & CO, INC	4	5.6
46	NETWORK-1 TECHNOLOG	48	79	60.8	IEEE	48	60.8	Internet Soc/IETF-Internet Eng Task Force	13	16.5
47	SMART WIRES INC	48	52	92.3	IEEE	48	92.3	ACM-Assoc Comput Mach	4	7.7
48	Dexcom Inc	47	346	13.6	RELX Group (Elsevier)	81	23.4	IEEE	47	13.6
49	Zebra Technologies Corp.	45	56	80.4	IEEE	45	80.4	RFID Journal/YGS Group	6	10.7
50	Georgia Institute of Technolo	44	112	39.3	ACM-Assoc Comput Mach	60	53.6	IEEE	44	39.3
51	AFERO INC	42	50	84.0	IEEE	42	84.0	United Business Media/UBM Tech	5	10.0
52	3M Co	40	58	69.0	IEEE	40	69.0	AIAA-Am Inst Aero Astro	3	5.2
53	SmartDrive Systems Inc	40	49	81.6	IEEE	40	81.6	ISIF/IEEE	4	8.2
54	Hello Inc	39	44	88.6	IEEE	39	88.6	ACM-Assoc Comput Mach	5	11.4
55	University of Minnesota (The	36	36	100.0	IEEE	36	100.0			
56	III HOLDINGS 12 LLC	35	50	70.0	IEEE	35	70.0	ACM-Assoc Comput Mach	6	12.0
57	Amazon.com Inc.	33	127	26.0	ACM-Assoc Comput Mach	34	26.8	IEEE	33	26.0
58	Ericsson	33	229	14.4	3GPP General Partnership Project Standards B	130	56.8	European Telecom Standards Institute (ETSI)	35	15.3
59	Witricity Corp	33	37	89.2	IEEE	33	89.2	American Institute of Physics	3	8.1
60	Knowles Corp	32	50	64.0	IEEE	32	64.0	RELX Group (Elsevier)	4	8.0
61	Hubbell Inc.	31	33	93.9	IEEE	31	93.9	Multidisciplinary Digital Publishing Institute (MDPI)	1	3.0
62	Panasonic Corporation	31	46	67.4	IEEE	31	67.4	Network Working Group RFC	6	13.0
63	Tigo Energy Inc	31	43	72.1	IEEE	31	72.1	WIP-Renewable Energies	9	20.9
64	Total SA	31	36	86.1	IEEE	31	86.1	EPE Association	4	11.1
65	Dell Technologies Inc	30	64	46.9	IEEE	30	46.9	ACM-Assoc Comput Mach	15	23.4
66	University of Maryland	30	30	100.0	IEEE	30	100.0			
67	PTC Inc	29	71	40.8	IEEE	29	40.8	ACM-Assoc Comput Mach	12	16.9
68	Boeing Co. (The)	28	51	54.9	IEEE	28	54.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	5.9
69	FedEx Corp	28	69	40.6	IEEE	28	40.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	6	8.7
70	Johnson Controls Internationa	28	61	45.9	IEEE	28	45.9	RELX Group (Elsevier)	7	11.5
71	Koninklijke Philips N.V.	28	164	17.1	IEEE	28	17.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	25	15.2
72	Schweitzer Engineering Labo	27	28	96.4	IEEE	27	96.4	IEC-International Electrotechnical Commission	1	3.6
73	ENERGY TECHNOLOGY G	26	30	86.7	IEEE	26	86.7	RELX Group (Elsevier)	2	6.7
74	PRODEA SYSTEMS INC	26	26	100.0	IEEE	26	100.0			
75	Accenture Ltd.	25	36	69.4	IEEE	25	69.4	A B B Corporate Management Services AG	4	11.1
76	Continental AG (Germany Fe	25	26	96.2	IEEE	25	96.2	Academy Publisher	1	3.8
77	Immersion Corp.	25	71	35.2	IEEE	25	35.2	ACM-Assoc Comput Mach	11	15.5
78	Legrand S.A.	25	81	30.9	IEEE	25	30.9	TIMES MIRROR MAG INC	11	13.6
79	PELTON TECHNOLOGY I	25	37	67.6	IEEE	25	67.6	IEEE/RSJ	4	10.8
80	THE FLORIDA INTERNATI	25	46	54.3	IEEE	25	54.3	ACM-Assoc Comput Mach	15	32.6

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Mitsubishi Electric Corp	24	48	50.0	IEEE	24	50.0	3GPP General Partnership Project Standards Body	18	37.5
82	Canon Inc	23	28	82.1	IEEE	23	82.1	ACM-Assoc Comput Mach	2	7.1
83	LSIS Co Ltd (Formerly LS In	23	27	85.2	IEEE	23	85.2	IET/IEE	3	11.1
84	SPARQ SYSTEMS INC	23	29	79.3	IEEE	23	79.3	RELX Group (Elsevier)	3	10.3
85	AXEDA CORP	22	53	41.5	IEEE	22	41.5	ACM-Assoc Comput Mach	9	17.0
86	Blackberry Ltd.	22	39	56.4	IEEE	22	56.4	ACM-Assoc Comput Mach	9	23.1
87	Huawei Technologies Compa	22	195	11.3	3GPP General Partnership Project Standards B	80	41.0	Open Mobile Alliance (Standards Org)	60	30.8
88	Toshiba Corp	22	33	66.7	IEEE	22	66.7	Internet Soc/IETF-Internet Eng Task Force	2	6.1
89	ConvergeOne Inc	21	24	87.5	IEEE	21	87.5	Internet Soc/IETF-Internet Eng Task Force	2	8.3
90	InterDigital Inc	21	219	9.6	3GPP General Partnership Project Standards B	133	60.7	European Telecom Standards Institute (ETSI)	34	15.5
91	Sony Corp	21	79	26.6	SID-Society for Information Display	24	30.4	IEEE	21	26.6
92	Taiwan Semiconductor Manu	21	39	53.8	IEEE	21	53.8	Electrostatic Discharge Association	15	38.5
93	Commscope Inc.	20	20	100.0	IEEE	20	100.0			
94	Corning Inc.	20	32	62.5	IEEE	20	62.5	IET/IEE	3	9.4
95	ICON Health & Fitness Inc	20	105	19.0	Consumers Union of the United States	27	25.7	IEEE	20	19.0
96	M2M & IOT TECHNOLOGI	20	56	35.7	Internet Soc/IETF-Internet Eng Task Force	24	42.9	IEEE	20	35.7
97	NORTHWATER INTELLEC	20	22	90.9	IEEE	20	90.9	ACM-Assoc Comput Mach	2	9.1
98	TEMPORAL POWER LTD	20	20	100.0	IEEE	20	100.0			
99	CenturyLink Inc	19	80	23.8	IEEE	19	23.8	ACM-Assoc Comput Mach	18	22.5
100	NURO INC	19	25	76.0	IEEE	19	76.0	IEEE/RSJ	2	8.0

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Measuring, Testing and Control Devices</i>										
1	Siemens Aktiengesellschaft	3190	7019	45.4	IEEE	3190	45.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1340	19.1
2	Thermo Fisher Scientific Inc	2980	14734	20.2	RELX Group (Elsevier)	4740	32.2	IEEE	2980	20.2
3	Partners HealthCare Systems	2903	40192	7.2	Optical Society of America	14578	36.3	RELX Group (Elsevier)	5464	13.6
4	International Business Machi	2195	5512	39.8	IEEE	2195	39.8	ACM-Assoc Comput Mach	305	5.5
5	Irobot Corp	2181	4024	54.2	IEEE	2181	54.2	SPIE-Int Soc Opt Engineering	578	14.4
6	Sanken Electric Co. Ltd.	1820	2241	81.2	IEEE	1820	81.2	RELX Group (Elsevier)	281	12.5
7	Honeywell International Inc.	1782	4454	40.0	IEEE	1782	40.0	RELX Group (Elsevier)	545	12.2
8	FormFactor Inc	1772	3395	52.2	IEEE	1772	52.2	MacMillan Publishing Company	642	18.9
9	Microsoft Corporation	1647	4233	38.9	IEEE	1647	38.9	ACM-Assoc Comput Mach	1027	24.3
10	Texas Instruments Inc	1613	1972	81.8	IEEE	1613	81.8	Joint IEEE and ACM	70	3.5
11	General Electric Company	1303	6723	19.4	IEEE	1303	19.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	970	14.4
12	illumina Inc.	960	3419	28.1	IEEE	960	28.1	Royal Society of Chemistry	477	14.0
13	Emerson Electric Co.	823	3481	23.6	IEEE	823	23.6	RELX Group (Elsevier)	429	12.3
14	California Institute of Techno	820	6260	13.1	RELX Group (Elsevier)	927	14.8	IEEE	820	13.1
15	Apple Inc	819	1757	46.6	IEEE	819	46.6	ACM-Assoc Comput Mach	225	12.8
16	ABB Ltd	730	1134	64.4	IEEE	730	64.4	RELX Group (Elsevier)	69	6.1
17	Applied Materials Inc.	705	1491	47.3	IEEE	705	47.3	American Institute of Physics	151	10.1
18	Broadcom Ltd	696	1135	61.3	IEEE	696	61.3	RELX Group (Elsevier)	59	5.2
19	Massachusetts Institute of Te	677	3870	17.5	IEEE	677	17.5	RELX Group (Elsevier)	524	13.5
20	AT&T Inc	674	1132	59.5	IEEE	674	59.5	ACM-Assoc Comput Mach	79	7.0
21	Intel Corporation	671	1554	43.2	IEEE	671	43.2	3GPP General Partnership Project Standards Body	116	7.5
22	Qualcomm Inc	654	1396	46.8	IEEE	654	46.8	3GPP General Partnership Project Standards Body	223	16.0
23	Nokia Corp	653	1639	39.8	IEEE	653	39.8	3GPP General Partnership Project Standards Body	109	6.7
24	Lockheed Martin Corp.	621	4799	12.9	American Institute of Physics	1028	21.4	IEEE	621	12.9
25	Midtronics Inc.	599	1363	43.9	IEEE	599	43.9	RELX Group (Elsevier)	237	17.4
26	Google Inc.	574	1542	37.2	IEEE	574	37.2	ACM-Assoc Comput Mach	294	19.1
27	NXP Semiconductors NV	573	867	66.1	IEEE	573	66.1	RELX Group (Elsevier)	56	6.5
28	Intuitive Surgical Inc.	570	1250	45.6	IEEE	570	45.6	SAGES-Society of American Gastrointestinal and Endoscopic	166	13.3
29	Schlumberger Ltd.	552	8531	6.5	Society of Exploration Geophysicists	1816	21.3	Society of Petroleum Engineers	1488	17.4
30	University of Minnesota (The	551	1784	30.9	IEEE	551	30.9	RELX Group (Elsevier)	263	14.7
31	Boeing Co. (The)	531	1780	29.8	IEEE	531	29.8	RELX Group (Elsevier)	214	12.0
32	CPG TECHNOLOGIES INC	528	648	81.5	IEEE	528	81.5	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	35	5.4
33	University of Illinois	526	5281	10.0	American Institute of Physics	895	16.9	RELX Group (Elsevier)	787	14.9
34	Synopsys Inc.	510	630	81.0	IEEE	510	81.0	Joint IEEE and ACM	42	6.7
35	INTOUCH HEALTH INC	484	1043	46.4	IEEE	484	46.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	57	5.5
36	Abbott Laboratories	466	14317	3.3	ACS-Am Chem Soc	3592	25.1	RELX Group (Elsevier)	3370	23.5
37	Infineon Technologies AG	451	706	63.9	IEEE	451	63.9	RELX Group (Elsevier)	74	10.5
38	Koninklijke Philips N.V.	448	2785	16.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	733	26.3	Society of Magnetic Resonance in Medicine (SMRM)	484	17.4
39	Honda Motor Co. Ltd.	447	1027	43.5	IEEE	447	43.5	RELX Group (Elsevier)	130	12.7

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	STMicroelectronics	439	677	64.8	IEEE	439	64.8	RELX Group (Elsevier)	86	12.7
41	Commissariat A L'Energie At	436	1663	26.2	IEEE	436	26.2	RELX Group (Elsevier)	404	24.3
42	Schneider Electric S.A.	429	2726	15.7	IEEE	429	15.7	RELX Group (Elsevier)	315	11.6
43	Samsung Electronics Co Ltd	426	1071	39.8	IEEE	426	39.8	RELX Group (Elsevier)	105	9.8
44	Duke University	416	1744	23.9	IEEE	416	23.9	RELX Group (Elsevier)	210	12.0
45	SolarEdge Technologies Inc	408	485	84.1	IEEE	408	84.1	WIP-Renewable Energies	33	6.8
46	Marvell Technology Group Lt	398	456	87.3	IEEE	398	87.3	Bluetooth Special Interest Group	11	2.4
47	University of California	398	6771	5.9	RELX Group (Elsevier)	1031	15.2	ACS-Am Chem Soc	975	14.4
48	Cypress Semiconductor Corp.	391	551	71.0	IEEE	391	71.0	Joint IEEE and ACM	41	7.4
49	Analog Devices Inc.	385	535	72.0	IEEE	385	72.0	American Institute of Physics	21	3.9
50	Ericsson	376	921	40.8	IEEE	376	40.8	3GPP General Partnership Project Standards Body	180	19.5
51	FARO Technologies Inc.	374	961	38.9	IEEE	374	38.9	SPIE-Int Soc Opt Engineering	156	16.2
52	Rockwell Automation Inc	372	614	60.6	IEEE	372	60.6	RELX Group (Elsevier)	69	11.2
53	Agilent Technologies Inc	369	1557	23.7	IEEE	369	23.7	RELX Group (Elsevier)	258	16.6
54	Advantest Corp.	365	503	72.6	IEEE	365	72.6	American Institute of Physics	26	5.2
55	INDIVIDUAL PATENTER	361	1528	23.6	IEEE	361	23.6	Optical Society of America	168	11.0
56	Industrial Technology Researc	361	785	46.0	IEEE	361	46.0	RELX Group (Elsevier)	125	15.9
57	University of Texas	358	2382	15.0	RELX Group (Elsevier)	360	15.1	IEEE	358	15.0
58	Stanford University	355	3296	10.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	420	12.7	Optical Society of America	389	11.8
59	HP Inc	348	1298	26.8	IEEE	348	26.8	ACS-Am Chem Soc	124	9.6
60	HRL Laboratories LLC	346	760	45.5	IEEE	346	45.5	RELX Group (Elsevier)	82	10.8
61	ParkerVision Inc	332	531	62.5	IEEE	332	62.5	IET/IEE	50	9.4
62	NEC Corp	331	775	42.7	IEEE	331	42.7	IEICE-Inst Elec Info Comm Eng	43	5.5
63	United States Navy	329	1828	18.0	IEEE	329	18.0	RELX Group (Elsevier)	260	14.2
64	Battelle Memorial Institute	323	1296	24.9	IEEE	323	24.9	RELX Group (Elsevier)	275	21.2
65	Micron Technology Inc.	318	586	54.3	IEEE	318	54.3	RELX Group (Elsevier)	41	7.0
66	HEMOSONICS LLC	311	488	63.7	IEEE	311	63.7	RELX Group (Elsevier)	47	9.6
67	Schweitzer Engineering Labo	304	343	88.6	IEEE	304	88.6	RELX Group (Elsevier)	15	4.4
68	Georgia Institute of Technolo	297	970	30.6	IEEE	297	30.6	Optical Society of America	123	12.7
69	Cisco Systems Inc.	295	1343	22.0	Internet Soc/IETF-Internet Eng Task Force	410	30.5	IEEE	295	22.0
70	Panasonic Corporation	294	1024	28.7	IEEE	294	28.7	RELX Group (Elsevier)	215	21.0
71	Advanced Micro Devices Inc	285	630	45.2	IEEE	285	45.2	SPIE-Int Soc Opt Engineering	70	11.1
72	Brain Corporation	285	504	56.5	IEEE	285	56.5	MIT Press	69	13.7
73	Bosch (Robert) GmbH	279	862	32.4	IEEE	279	32.4	RELX Group (Elsevier)	125	14.5
74	Toyota Motor Corp	277	658	42.1	IEEE	277	42.1	ACM-Assoc Comput Mach	80	12.2
75	Raytheon Co.	269	871	30.9	IEEE	269	30.9	SPIE-Int Soc Opt Engineering	125	14.4
76	Taiwan Semiconductor Manu	269	419	64.2	IEEE	269	64.2	American Institute of Physics	25	6.0
77	Xerox Corp	267	1056	25.3	IEEE	267	25.3	American Institute of Physics	101	9.6
78	Mitsubishi Electric Corp	265	541	49.0	IEEE	265	49.0	RELX Group (Elsevier)	35	6.5
79	University of Southern Califo	257	591	43.5	IEEE	257	43.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	38	6.4
80	General Motors Corp	255	507	50.3	IEEE	255	50.3	RELX Group (Elsevier)	53	10.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Adaptix	252	374	67.4	IEEE	252	67.4	European Telecom Standards Institute (ETSI)	47	12.6
82	Toshiba Corp	240	1013	23.7	IEEE	240	23.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	215	21.2
83	ZOOX INC	239	293	81.6	IEEE	239	81.6	IEEE/RSJ	20	6.8
84	Teradyne Inc.	237	525	45.1	IEEE	237	45.1	ASME-Am Soc Mech Eng	79	15.0
85	Fujitsu Limited	235	532	44.2	IEEE	235	44.2	RELX Group (Elsevier)	34	6.4
86	MACAU UNIVERSITY OF	233	244	95.5	IEEE	233	95.5	IEEE/ASME	4	1.6
87	Hitachi Ltd	232	1472	15.8	IEEE	232	15.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	212	14.4
88	Sony Corp	232	583	39.8	IEEE	232	39.8	RELX Group (Elsevier)	44	7.5
89	Nintendo Co. Ltd.	230	825	27.9	IEEE	230	27.9	ACM-Assoc Comput Mach	165	20.0
90	OMNI MEDSCI INC	228	1213	18.8	Optical Society of America	325	26.8	IEEE	228	18.8
91	University of Michigan	227	1295	17.5	IEEE	227	17.5	RELX Group (Elsevier)	193	14.9
92	Verizon Communications Inc	227	535	42.4	IEEE	227	42.4	Internet Soc/IETF-Internet Eng Task Force	61	11.4
93	Canon Inc	225	1681	13.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	318	18.9	IEEE	225	13.4
94	Halliburton Co. (Holding)	224	4634	4.8	Society of Petroleum Engineers	1568	33.8	SPWLA-Society of Petrophysicists and Well Log Analysts	686	14.8
95	L3 Harris Technologies (form	220	573	38.4	IEEE	220	38.4	American Institute of Physics	45	7.9
96	Purdue University	217	1472	14.7	RELX Group (Elsevier)	281	19.1	ACS-Am Chem Soc	246	16.7
97	Immersion Corp.	214	492	43.5	IEEE	214	43.5	ASME-Am Soc Mech Eng	41	8.3
98	KLA-Tencor Corp.	214	3116	6.9	SPIE-Int Soc Opt Engineering	759	24.4	Optical Society of America	549	17.6
99	Oracle Corporation	212	455	46.6	IEEE	212	46.6	3GPP General Partnership Project Standards Body	37	8.1
100	Fluidigm Corp	211	1515	13.9	ACS-Am Chem Soc	253	16.7	IEEE	211	13.9

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Optics/Photography/Electrophotography</i>										
1	Qualcomm Inc	1837	5099	36.0	IEEE	1837	36.0	SID-Society for Information Display	919	18.0
2	Infinera Corporation	1177	2186	53.8	IEEE	1177	53.8	IET/IEE	356	16.3
3	Partners HealthCare Systems	806	11926	6.8	Optical Society of America	4479	37.6	RELX Group (Elsevier)	1676	14.1
4	IDC Llc	642	1779	36.1	IEEE	642	36.1	SID-Society for Information Display	236	13.3
5	Nikon Corp.	610	4162	14.7	SPIE-Int Soc Opt Engineering	1854	44.5	SEMATECH Consortium	818	19.7
6	II-VI Inc	585	1681	34.8	IEEE	585	34.8	Optical Society of America	287	17.1
7	Corning Inc.	542	3750	14.5	Optical Society of America	811	21.6	IEEE	542	14.5
8	Massachusetts Institute of Te	524	2952	17.8	IEEE	524	17.8	Optical Society of America	460	15.6
9	Nokia Corp	505	2239	22.6	IEEE	505	22.6	Optical Society of America	405	18.1
10	Microsoft Corporation	455	1243	36.6	IEEE	455	36.6	ACM-Assoc Comput Mach	277	22.3
11	Synopsys Inc.	439	3099	14.2	SPIE-Int Soc Opt Engineering	1450	46.8	Institute of Pure and Applied Physics	462	14.9
12	Google Inc.	427	934	45.7	IEEE	427	45.7	RELX Group (Elsevier)	73	7.8
13	YFY Inc	423	4830	8.8	SID-Society for Information Display	1876	38.8	National Symposium on Information Display	494	10.2
14	Hoya Corp	421	1313	32.1	IEEE	421	32.1	American Institute of Physics	262	20.0
15	Mellanox Technologies Ltd	403	1250	32.2	IEEE	403	32.2	IET/IEE	290	23.2
16	The Invention Science Fund 1	389	1647	23.6	IEEE	389	23.6	American Physical Society	228	13.8
17	Xperi Corporation (Formerly	373	727	51.3	IEEE	373	51.3	Optical Society of America	94	12.9
18	Screen Holdings Co Ltd (For	368	1372	26.8	IEEE	368	26.8	RELX Group (Elsevier)	211	15.4
19	Intel Corporation	347	1165	29.8	IEEE	347	29.8	SPIE-Int Soc Opt Engineering	170	14.6
20	International Business Machi	316	1969	16.0	SPIE-Int Soc Opt Engineering	484	24.6	IEEE	316	16.0
21	Ericsson	313	1360	23.0	Optical Society of America	522	38.4	IEEE	313	23.0
22	Cheetah Omni LLC	294	1151	25.5	IEEE	294	25.5	Optical Society of America	274	23.8
23	California Institute of Techno	253	1782	14.2	Optical Society of America	512	28.7	IEEE	253	14.2
24	Stanford University	251	1670	15.0	Optical Society of America	313	18.7	IEEE	251	15.0
25	ASML Holding NV	250	7942	3.1	SPIE-Int Soc Opt Engineering	2812	35.4	American Institute of Physics	1625	20.5
26	Texas Instruments Inc	232	860	27.0	IEEE	232	27.0	American Institute of Physics	151	17.6
27	Adobe Inc.	219	512	42.8	IEEE	219	42.8	ACM-Assoc Comput Mach	127	24.8
28	University of California	213	1520	14.0	IEEE	213	14.0	Optical Society of America	204	13.4
29	Viavi Solutions Inc	201	864	23.3	IEEE	201	23.3	Optical Society of America	149	17.2
30	3M Co	200	3856	5.2	Optical Society of America	585	15.2	RELX Group (Elsevier)	384	10.0
31	University of Arizona	196	774	25.3	IEEE	196	25.3	Optical Society of America	164	21.2
32	Osterhout Design Group	187	543	34.4	IEEE	187	34.4	ACM-Assoc Comput Mach	162	29.8
33	Micron Technology Inc.	186	1900	9.8	American Institute of Physics	370	19.5	SPIE-Int Soc Opt Engineering	337	17.7
34	Siemens Aktiengesellschaft	183	592	30.9	IEEE	183	30.9	SPIE-Int Soc Opt Engineering	128	21.6
35	University of Colorado (The	181	1453	12.5	Optical Society of America	505	34.8	IEEE	181	12.5
36	Lockheed Martin Corp.	180	1000	18.0	Optical Society of America	254	25.4	IEEE	180	18.0
37	HP Inc	177	911	19.4	IEEE	177	19.4	Optical Society of America	104	11.4
38	Princeton University	172	394	43.7	IEEE	172	43.7	American Institute of Physics	44	11.2
39	Fujitsu Limited	168	870	19.3	IEEE	168	19.3	Optical Society of America	137	15.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Prysmian SPA	165	927	17.8	Optical Society of America	211	22.8	IEEE	165	17.8
41	United States of America Dep	163	653	25.0	IEEE	163	25.0	IET/IEEE	131	20.1
42	Cisco Systems Inc.	153	357	42.9	IEEE	153	42.9	Optical Society of America	74	20.7
43	Electronics and Telecommuni	153	434	35.3	IEEE	153	35.3	Optical Society of America	63	14.5
44	Canon Inc	147	1899	7.7	SPIE-Int Soc Opt Engineering	268	14.1	American Institute of Physics	240	12.6
45	Pelican Imaging Corporation	139	302	46.0	IEEE	139	46.0	SPIE-Int Soc Opt Engineering	53	17.5
46	CIRREX SYSTEMS LLC	136	615	22.1	IEEE	136	22.1	Optical Society of America	89	14.5
47	Honeywell International Inc.	136	606	22.4	IEEE	136	22.4	SPIE-Int Soc Opt Engineering	107	17.7
48	University of Texas	136	1079	12.6	American Institute of Physics	189	17.5	Optical Society of America	149	13.8
49	Georgia Institute of Technolo	135	437	30.9	IEEE	135	30.9	Optical Society of America	80	18.3
50	OmniGuide Inc	134	1019	13.2	Optical Society of America	242	23.7	IEEE	134	13.2
51	Emcore Corp.	133	168	79.2	IEEE	133	79.2	IEEE/OSA	11	6.5
52	VASCULAR IMAGING CO	133	281	47.3	IEEE	133	47.3	IET/IEEE	80	28.5
53	ALENTIC MICROSCIENCE	126	231	54.5	IEEE	126	54.5	American Institute of Physics	16	6.9
54	Cubic Wafer Inc	126	224	56.3	IEEE	126	56.3	SPIE-Int Soc Opt Engineering	42	18.8
55	Huawei Technologies Compa	124	249	49.8	IEEE	124	49.8	Optical Society of America	46	18.5
56	Xerox Corp	124	1259	9.8	ACS-Am Chem Soc	245	19.5	RELX Group (Elsevier)	174	13.8
57	Koninklijke Philips N.V.	119	660	18.0	SPIE-Int Soc Opt Engineering	169	25.6	IEEE	119	18.0
58	Furukawa Electric Co. Ltd.	109	800	13.6	Optical Society of America	259	32.4	IEEE	109	13.6
59	Sumitomo Electric Industries	108	996	10.8	Optical Society of America	250	25.1	European Conference on Optical Communication (ECOC) Soc	155	15.6
60	Nippon Telegraph & Telepho	105	605	17.4	IEEE	105	17.4	IET/IEEE	103	17.0
61	Lumentum Holdings Inc	103	424	24.3	IEEE	103	24.3	Optical Society of America	96	22.6
62	PTS Corporation	102	232	44.0	IEEE	102	44.0	Optical Society of America	34	14.7
63	Calient Technologies Inc.	101	200	50.5	IEEE	101	50.5	Optical Society of America	29	14.5
64	Neophotonics Corporation	100	308	32.5	IEEE	100	32.5	Optical Society of America	53	17.2
65	NEC Corp	97	654	14.8	IEEE	97	14.8	Technical Association of Photopolymers	66	10.1
66	RPX Corp	93	226	41.2	IEEE	93	41.2	IEEE/OSA	30	13.3
67	Broadcom Ltd	90	317	28.4	IEEE	90	28.4	SPIE-Int Soc Opt Engineering	66	20.8
68	Eastman Kodak Company	87	1254	6.9	RELX Group (Elsevier)	173	13.8	ACS-Am Chem Soc	167	13.3
69	Mitsubishi Electric Corp	87	280	31.1	IEEE	87	31.1	SPIE-Int Soc Opt Engineering	40	14.3
70	Applied Materials Inc.	86	525	16.4	SPIE-Int Soc Opt Engineering	124	23.6	American Institute of Physics	92	17.5
71	NXP Semiconductors NV	85	271	31.4	IEEE	85	31.4	American Institute of Physics	45	16.6
72	OMM INC	85	194	43.8	IEEE	85	43.8	SPIE-Int Soc Opt Engineering	43	22.2
73	Industrial Technology Researc	80	350	22.9	IEEE	80	22.9	SPIE-Int Soc Opt Engineering	53	15.1
74	Motorola Solutions Inc.	80	319	25.1	American Institute of Physics	92	28.8	IEEE	80	25.1
75	Samsung Electronics Co Ltd	80	958	8.4	American Institute of Physics	113	11.8	ACS-Am Chem Soc	112	11.7
76	Apple Inc	77	557	13.8	Optical Society of America	147	26.4	SPIE-Int Soc Opt Engineering	84	15.1
77	Oracle Corporation	77	143	53.8	IEEE	77	53.8	Optical Society of America	22	15.4
78	Oewaves Inc	76	253	30.0	Optical Society of America	100	39.5	IEEE	76	30.0
79	Seiko Epson Corporation	76	287	26.5	IEEE	76	26.5	SID-Society for Information Display	60	20.9
80	Commscope Inc.	75	560	13.4	IEEE/OSA	145	25.9	IEEE	75	13.4

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Panasonic Corporation	75	558	13.4	SPIE-Int Soc Opt Engineering	93	16.7	IEEE	75	13.4
82	North Inc. (formerly Thalmic)	74	275	26.9	IEEE	74	26.9	SID-Society for Information Display	66	24.0
83	Extreme Networks Inc	72	166	43.4	IEEE	72	43.4	ACM-Assoc Comput Mach	22	13.3
84	AT&T Inc	71	120	59.2	IEEE	71	59.2	RELX Group (Elsevier)	11	9.2
85	HRL Laboratories LLC	70	292	24.0	IEEE	70	24.0	American Institute of Physics	50	17.1
86	Fujikara Ltd.	67	606	11.1	Optical Society of America	167	27.6	IEICE-Inst Elec Info Comm Eng	113	18.6
87	Hong Kong University of Sci	66	132	50.0	IEEE	66	50.0	RELX Group (Elsevier)	9	6.8
88	Cornell University	65	505	12.9	IEEE	65	12.9	RELX Group (Elsevier)	59	11.7
89	Juniper Networks Inc.	65	96	67.7	IEEE	65	67.7	Optical Society of America	19	19.8
90	Olympus Corp.	63	432	14.6	Optical Society of America	110	25.5	IEEE	63	14.6
91	Carl-Zeiss Stiftung	62	2595	2.4	SPIE-Int Soc Opt Engineering	1041	40.1	Optical Society of America	501	19.3
92	Skorpios Technologies Inc	62	100	62.0	IEEE	62	62.0	Optical Society of America	20	20.0
93	Aisin Seiki Co. Ltd.	61	552	11.1	Optical Society of America	274	49.6	IEEE	61	11.1
94	Shin-Etsu Chemical Co. Ltd.	61	1519	4.0	SPIE-Int Soc Opt Engineering	758	49.9	Technical Association of Photopolymers	374	24.6
95	STMicroelectronics	61	155	39.4	IEEE	61	39.4	SPIE-Int Soc Opt Engineering	26	16.8
96	United States Navy	61	444	13.7	Optical Society of America	84	18.9	IEEE	61	13.7
97	University of Washington	61	382	16.0	SPIE-Int Soc Opt Engineering	76	19.9	American Institute of Physics	62	16.2
98	Velatia Group	61	77	79.2	IEEE	61	79.2	Echelon Corp	7	9.1
99	OMNI MEDSCI INC	60	555	10.8	Optical Society of America	159	28.6	RELX Group (Elsevier)	90	16.2
100	University of Illinois	60	379	15.8	American Institute of Physics	112	29.6	IEEE	60	15.8

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Power Systems</i>										
1	Witricity Corp	3785	6238	60.7	IEEE	3785	60.7	American Institute of Physics	539	8.6
2	SolarEdge Technologies Inc	3348	3866	86.6	IEEE	3348	86.6	WIP-Renewable Energies	236	6.1
3	CPG TECHNOLOGIES INC	2371	3069	77.3	IEEE	2371	77.3	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	155	5.1
4	Flex Ltd (Formerly Flextronic	1651	1778	92.9	IEEE	1651	92.9	United Business Media/UBM Tech	71	4.0
5	Cirrus Logic Inc.	1578	1734	91.0	IEEE	1578	91.0	ISO-International Standards Organization	50	2.9
6	ABB Ltd	1566	2326	67.3	IEEE	1566	67.3	IVI Foundation/SCPI Consortium	94	4.0
7	Energous Corporation	1289	1609	80.1	IEEE	1289	80.1	Rajagiri School of Engineering & Technology, Cochin, Kerala,	150	9.3
8	Massachusetts Institute of Te	1208	3160	38.2	IEEE	1208	38.2	Electrochemical Society, Inc.	455	14.4
9	Rockwell Automation Inc	1186	1282	92.5	IEEE	1186	92.5	EPE Association	36	2.8
10	Enphase Energy Inc	1175	1298	90.5	IEEE	1175	90.5	IET/IEE	43	3.3
11	General Electric Company	1165	2886	40.4	IEEE	1165	40.4	US Dept of Energy	773	26.8
12	SYNQOR INC	894	1025	87.2	IEEE	894	87.2	Penton/IPC, Inc.	45	4.4
13	Texas Instruments Inc	784	915	85.7	IEEE	784	85.7	RELX Group (Elsevier)	29	3.2
14	MOJO MOBILITY INC	616	786	78.4	IEEE	616	78.4	RELX Group (Elsevier)	54	6.9
15	Intel Corporation	599	726	82.5	IEEE	599	82.5	IEEE/JPN Soc App Phys	19	2.6
16	AMPT LLC	575	715	80.4	IEEE	575	80.4	IET/IEE	38	5.3
17	Infineon Technologies AG	553	625	88.5	IEEE	553	88.5	EPE Association	11	1.8
18	Total SA	547	641	85.3	IEEE	547	85.3	IET/IEE	18	2.8
19	Maxim Integrated Products In	442	477	92.7	IEEE	442	92.7	Texas Instruments	16	3.4
20	STMicroelectronics	417	514	81.1	IEEE	417	81.1	RELX Group (Elsevier)	21	4.1
21	Qualcomm Inc	413	530	77.9	IEEE	413	77.9	RELX Group (Elsevier)	32	6.0
22	Renesas Electronic Corporati	391	478	81.8	IEEE	391	81.8	IEEE/JPN Soc App Phys	11	2.3
23	NXP Semiconductors NV	382	451	84.7	IEEE	382	84.7	IET/IEE	13	2.9
24	Analog Devices Inc.	371	1022	36.3	RELX Group (Elsevier)	402	39.3	IEEE	371	36.3
25	Vicor Corp	360	440	81.8	IEEE	360	81.8	Center for Power Electronics Systems (Virginia Tech)	39	8.9
26	Qorvo	344	404	85.1	IEEE	344	85.1	European Microwave Association	14	3.5
27	Irobot Corp	325	591	55.0	IEEE	325	55.0	SPIE-Int Soc Opt Engineering	92	15.6
28	Industrial Technology Researc	317	603	52.6	IEEE	317	52.6	RELX Group (Elsevier)	148	24.5
29	Dialog Semiconductor Plc.	307	347	88.5	IEEE	307	88.5	ONLINE INC	18	5.2
30	Siemens Aktiengesellschaft	303	590	51.4	IEEE	303	51.4	AIAA-Am Inst Aero Astro	68	11.5
31	Alstom	294	383	76.8	IEEE	294	76.8	IET/IEE	24	6.3
32	International Business Machi	289	484	59.7	IEEE	289	59.7	RELX Group (Elsevier)	37	7.6
33	Tigo Energy Inc	274	377	72.7	IEEE	274	72.7	WIP-Renewable Energies	77	20.4
34	Power Integrations Inc.	265	411	64.5	IEEE	265	64.5	Penton/IPC, Inc.	66	16.1
35	Murata Manufacturing Co. Lt	262	330	79.4	IEEE	262	79.4	RELX Group (Elsevier)	20	6.1
36	Eaton Corp.	227	302	75.2	IEEE	227	75.2	RELX Group (Elsevier)	16	5.3
37	Broadcom Ltd	225	285	78.9	IEEE	225	78.9	American Institute of Physics	10	3.5
38	Toshiba Corp	216	787	27.4	RELX Group (Elsevier)	272	34.6	IEEE	216	27.4
39	Schneider Electric S.A.	211	276	76.4	IEEE	211	76.4	IEEE/DOE/JPL	9	3.3

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	University of Illinois	211	943	22.4	RELX Group (Elsevier)	350	37.1	IEEE	211	22.4
41	Microchip Technology Inc.	209	245	85.3	IEEE	209	85.3	IEICE-Inst Elec Info Comm Eng	9	3.7
42	Midtronics Inc.	194	487	39.8	IEEE	194	39.8	RELX Group (Elsevier)	81	16.6
43	Vertiv Corp	187	204	91.7	IEEE	187	91.7	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	1.5
44	University of Wisconsin	184	237	77.6	IEEE	184	77.6	RELX Group (Elsevier)	11	4.6
45	Semiconductor Energy Labor	180	2747	6.6	SID-Society for Information Display	634	23.1	American Institute of Physics	368	13.4
46	Delta Electronics Inc	176	200	88.0	IEEE	176	88.0	Korean Institute of Power Electronics	12	6.0
47	Apple Inc	175	633	27.6	IEEE	175	27.6	RELX Group (Elsevier)	104	16.4
48	California Institute of Techno	175	2294	7.6	RELX Group (Elsevier)	784	34.2	Electrochemical Society, Inc.	387	16.9
49	Powermat Technologies Ltd	170	175	97.1	IEEE	170	97.1	American Institute of Physics	4	2.3
50	Nokia Corp	169	326	51.8	IEEE	169	51.8	RELX Group (Elsevier)	30	9.2
51	Raytheon Co.	161	195	82.6	IEEE	161	82.6	IET/IEE	7	3.6
52	Micron Technology Inc.	159	230	69.1	IEEE	159	69.1	IEEE/JPN Soc App Phys	22	9.6
53	R2 SEMICONDUCTOR INC	158	161	98.1	IEEE	158	98.1	European Microwave Association	2	1.2
54	Microsoft Corporation	157	344	45.6	IEEE	157	45.6	ACM-Assoc Comput Mach	50	14.5
55	General Motors Corp	156	1851	8.4	RELX Group (Elsevier)	746	40.3	Electrochemical Society, Inc.	302	16.3
56	Hong Kong University of Sci	156	251	62.2	IEEE	156	62.2	RELX Group (Elsevier)	34	13.5
57	Marvell Technology Group Lt	155	188	82.4	IEEE	155	82.4	Texas Instruments	16	8.5
58	On Semiconductor Corporati	155	182	85.2	IEEE	155	85.2	Penton/IPC, Inc.	8	4.4
59	O2Micro International Ltd.	152	232	65.5	IEEE	152	65.5	Texas Instruments	33	14.2
60	Samsung Electronics Co Ltd	152	1173	13.0	RELX Group (Elsevier)	347	29.6	ACS-Am Chem Soc	160	13.6
61	United Technologies Corp	147	721	20.4	IEEE	147	20.4	NASA-National Aeronautics and Space Admin	75	10.4
62	GENESIS ROBOTICS LLC	144	180	80.0	IEEE	144	80.0	IET/IEE	9	5.0
63	Boeing Co. (The)	141	357	39.5	IEEE	141	39.5	RELX Group (Elsevier)	49	13.7
64	Koninklijke Philips N.V.	141	197	71.6	IEEE	141	71.6	IET/IEE	10	5.1
65	Mitsubishi Electric Corp	141	206	68.4	IEEE	141	68.4	IET/IEE	23	11.2
66	Silicon Laboratories Inc	141	159	88.7	IEEE	141	88.7	SAE-Society of Automobile Engineers	12	7.5
67	PSEMI CORP	138	142	97.2	IEEE	138	97.2	Joint IEEE and ACM	3	2.1
68	Emerson Electric Co.	137	210	65.2	IEEE	137	65.2	IET/IEE	18	8.6
69	Huawei Technologies Compa	136	151	90.1	IEEE	136	90.1	Audio Eng Soc	3	2.0
70	Western Digital Corp.	134	163	82.2	IEEE	134	82.2	McGraw Hill	16	9.8
71	Tesla Motors Inc	133	152	87.5	IEEE	133	87.5	China Electrochemical Society	5	3.3
72	THE FLORIDA INTERNATI	132	140	94.3	IEEE	132	94.3	IET/IEE	4	2.9
73	INFINITE POWER SOLUTI	130	1395	9.3	RELX Group (Elsevier)	317	22.7	American Institute of Physics	309	22.2
74	University of California	128	1030	12.4	RELX Group (Elsevier)	200	19.4	ACS-Am Chem Soc	163	15.8
75	Panasonic Corporation	124	1230	10.1	RELX Group (Elsevier)	371	30.2	Electrochemical Society, Inc.	316	25.7
76	SRI International	124	705	17.6	SPIE-Int Soc Opt Engineering	152	21.6	IEEE	124	17.6
77	Arizona State University	122	615	19.8	RELX Group (Elsevier)	144	23.4	IEEE	122	19.8
78	Conversant Intellectual Prope	120	144	83.3	IEEE	120	83.3	Joint IEEE and ACM	12	8.3
79	FYRE STORM INC	118	124	95.2	IEEE	118	95.2	Scripta Pub Co.	3	2.4
80	MOTOR EXCELLENCE LL	111	125	88.8	IEEE	111	88.8	IEEE/ASME	14	11.2

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	University of Alabama	111	121	91.7	IEEE	111	91.7	IET/IEE	7	5.8
82	TDK Corporation	110	262	42.0	IEEE	110	42.0	RELX Group (Elsevier)	56	21.4
83	Advanced Energy Industries I	109	117	93.2	IEEE	109	93.2	IET/IEE	3	2.6
84	Utah State University	109	124	87.9	IEEE	109	87.9	IET/IEE	6	4.8
85	Cypress Semiconductor Corp.	107	123	87.0	IEEE	107	87.0	IEEE/JPN Soc App Phys	6	4.9
86	University of Colorado (The	103	112	92.0	IEEE	103	92.0	RELX Group (Elsevier)	3	2.7
87	Schweitzer Engineering Labo	102	104	98.1	IEEE	102	98.1	IET/IEE	1	1.0
88	University of Texas	101	751	13.4	RELX Group (Elsevier)	201	26.8	Electrochemical Society, Inc.	120	16.0
89	Lenovo Group Ltd	100	124	80.6	IEEE	100	80.6	RELX Group (Elsevier)	9	7.3
90	Lockheed Martin Corp.	99	709	14.0	RELX Group (Elsevier)	175	24.7	ACS-Am Chem Soc	107	15.1
91	Google Inc.	98	140	70.0	IEEE	98	70.0	ACM-Assoc Comput Mach	12	8.6
92	Honeywell International Inc.	98	337	29.1	RELX Group (Elsevier)	113	33.5	IEEE	98	29.1
93	Alticor Inc	94	121	77.7	IEEE	94	77.7	RELX Group (Elsevier)	9	7.4
94	Commissariat A L'Energie At	94	520	18.1	RELX Group (Elsevier)	191	36.7	IEEE	94	18.1
95	University of Michigan	94	300	31.3	IEEE	94	31.3	Electrochemical Society, Inc.	64	21.3
96	ENECSYS LTD	91	101	90.1	IEEE	91	90.1	WIP-Renewable Energies	5	5.0
97	Bosch (Robert) GmbH	89	802	11.1	Electrochemical Society, Inc.	191	23.8	RELX Group (Elsevier)	175	21.8
98	Hitachi Ltd	89	270	33.0	IEEE	89	33.0	IET/IEE	45	16.7
99	IDEAL POWER INC	87	106	82.1	IEEE	87	82.1	EPE Association	15	14.2
100	TechnipFMC	87	120	72.5	IEEE	87	72.5	ASME-Am Soc Mech Eng	12	10.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Robotics and Intelligent Manufacturing</i>										
1	Irobot Corp	5752	9806	58.7	IEEE	5752	58.7	SPIE-Int Soc Opt Engineering	1271	13.0
2	Intuitive Surgical Inc.	4728	8039	58.8	IEEE	4728	58.8	SAGES-Society of American Gastrointestinal and Endoscopic	380	4.7
3	Applied Materials Inc.	1600	2707	59.1	IEEE	1600	59.1	American Institute of Physics	155	5.7
4	INTOUCH HEALTH INC	1372	2726	50.3	IEEE	1372	50.3	IEEE/RSJ	144	5.3
5	Brain Corporation	775	1429	54.2	IEEE	775	54.2	MIT Press	232	16.2
6	Honda Motor Co. Ltd.	694	1566	44.3	IEEE	694	44.3	RELX Group (Elsevier)	188	12.0
7	Massachusetts Institute of Te	629	1472	42.7	IEEE	629	42.7	RELX Group (Elsevier)	209	14.2
8	Microsoft Corporation	624	1690	36.9	IEEE	624	36.9	ACM-Assoc Comput Mach	345	20.4
9	University of Nebraska	592	1982	29.9	IEEE	592	29.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	291	14.7
10	International Business Machi	548	1542	35.5	IEEE	548	35.5	ACM-Assoc Comput Mach	186	12.1
11	Stryker Corp.	516	1336	38.6	IEEE	516	38.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	202	15.1
12	Vanderbilt University	439	581	75.6	IEEE	439	75.6	IEEE/RSJ	41	7.1
13	Sony Corp	409	541	75.6	IEEE	409	75.6	IEEE/RSJ	24	4.4
14	Siemens Aktiengesellschaft	397	920	43.2	IEEE	397	43.2	RELX Group (Elsevier)	103	11.2
15	PDF Solutions	343	438	78.3	IEEE	343	78.3	SPIE-Int Soc Opt Engineering	61	13.9
16	Immersion Corp.	314	780	40.3	IEEE	314	40.3	ACM-Assoc Comput Mach	76	9.7
17	Samsung Electronics Co Ltd	271	405	66.9	IEEE	271	66.9	IEEE/RSJ	32	7.9
18	X Development Llc	261	373	70.0	IEEE	261	70.0	IEEE/RSJ	44	11.8
19	HRL Laboratories LLC	257	425	60.5	IEEE	257	60.5	SPIE-Int Soc Opt Engineering	26	6.1
20	Google Inc.	253	475	53.3	IEEE	253	53.3	ACM-Assoc Comput Mach	84	17.7
21	Otto Bock Holding GmbH &	243	398	61.1	IEEE	243	61.1	RELX Group (Elsevier)	43	10.8
22	SIPCO LLC	238	414	57.5	IEEE	238	57.5	Internet Soc/IETF-Internet Eng Task Force	35	8.5
23	Medrobotics Corp	227	478	47.5	IEEE	227	47.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	95	19.9
24	Advanced Micro Devices Inc	219	449	48.8	IEEE	219	48.8	RELX Group (Elsevier)	51	11.4
25	MACAU UNIVERSITY OF	215	225	95.6	IEEE	215	95.6	IEEE/ASME	3	1.3
26	Johns Hopkins University	212	358	59.2	IEEE	212	59.2	RELX Group (Elsevier)	21	5.9
27	Johnson & Johnson	210	1039	20.2	IEEE	210	20.2	RELX Group (Elsevier)	181	17.4
28	Cadence Design Systems Inc	194	454	42.7	IEEE	194	42.7	Joint IEEE and ACM	158	34.8
29	SRI International	181	411	44.0	IEEE	181	44.0	SPIE-Int Soc Opt Engineering	56	13.6
30	Cimpress NV	179	435	41.1	IEEE	179	41.1	RELX Group (Elsevier)	121	27.8
31	General Electric Company	177	316	56.0	IEEE	177	56.0	RELX Group (Elsevier)	21	6.6
32	Boeing Co. (The)	175	450	38.9	IEEE	175	38.9	RELX Group (Elsevier)	91	20.2
33	ZOOX INC	170	204	83.3	IEEE	170	83.3	IEEE/RSJ	15	7.4
34	Emerson Electric Co.	168	657	25.6	IEEE	168	25.6	RELX Group (Elsevier)	91	13.9
35	L3 Harris Technologies (form	151	218	69.3	IEEE	151	69.3	Society of Petroleum Engineers	16	7.3
36	ICOSYSTEM CORP	150	198	75.8	IEEE	150	75.8	IET/IEE	10	5.1
37	Bonutti Technologies LLC	148	530	27.9	IEEE	148	27.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	138	26.0
38	ABB Ltd	147	217	67.7	IEEE	147	67.7	RELX Group (Elsevier)	21	9.7
39	Battelle Memorial Institute	144	195	73.8	IEEE	144	73.8	IEEE/RSJ	19	9.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	University of Southern Califo	133	206	64.6	IEEE	133	64.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	15	7.3
41	Fanuc Ltd.	131	207	63.3	IEEE	131	63.3	RELX Group (Elsevier)	18	8.7
42	Broadcom Ltd	130	229	56.8	IEEE	130	56.8	RELX Group (Elsevier)	40	17.5
43	WALMART APOLLO LLC	130	181	71.8	IEEE	130	71.8	IEEE/RSJ	21	11.6
44	Honeywell International Inc.	128	281	45.6	IEEE	128	45.6	RELX Group (Elsevier)	37	13.2
45	IWALK INC	128	262	48.9	IEEE	128	48.9	RELX Group (Elsevier)	38	14.5
46	GENESIS ROBOTICS LLC	127	156	81.4	IEEE	127	81.4	IET/IEE	8	5.1
47	Rockwell Automation Inc	124	229	54.1	IEEE	124	54.1	RELX Group (Elsevier)	27	11.8
48	MONOLITHIC 3D INC	123	221	55.7	IEEE	123	55.7	IEEE/JPN Soc App Phys	24	10.9
49	ROY-G-BIV CORP	123	385	31.9	IEEE	123	31.9	ISO-International Standards Organization	67	17.4
50	Xerox Corp	122	276	44.2	IEEE	122	44.2	ACM-Assoc Comput Mach	37	13.4
51	University of Washington	120	240	50.0	IEEE	120	50.0	RELX Group (Elsevier)	17	7.1
52	Walt Disney Co.	116	256	45.3	IEEE	116	45.3	ACM-Assoc Comput Mach	60	23.4
53	Taiwan Semiconductor Manu	114	210	54.3	IEEE	114	54.3	SPIE-Int Soc Opt Engineering	18	8.6
54	University of Minnesota (The	112	160	70.0	IEEE	112	70.0	IEEE/RSJ	12	7.5
55	University of Pennsylvania	111	137	81.0	IEEE	111	81.0	IEEE/RSJ	15	10.9
56	INDIVIDUAL PATENTER	103	239	43.1	IEEE	103	43.1	ACM-Assoc Comput Mach	10	4.2
57	Toshiba Corp	103	168	61.3	IEEE	103	61.3	RELX Group (Elsevier)	7	4.2
58	Fujitsu Limited	98	168	58.3	IEEE	98	58.3	RELX Group (Elsevier)	14	8.3
59	Amada Holdings Co. Ltd.	97	271	35.8	IEEE	97	35.8	RELX Group (Elsevier)	61	22.5
60	Lockheed Martin Corp.	97	239	40.6	IEEE	97	40.6	RELX Group (Elsevier)	19	7.9
61	American Express Co.	96	343	28.0	IEEE	96	28.0	The USENIX Association	39	11.4
62	Panasonic Corporation	96	196	49.0	IEEE	96	49.0	RSJ-Robotics Society of Japan	12	6.1
63	Tokyo Electron Limited	96	241	39.8	IEEE	96	39.8	RELX Group (Elsevier)	26	10.8
64	Align Technology Inc	95	541	17.6	IEEE	95	17.6	JCO - Journal of Clinical Orthodontics	93	17.2
65	Tela Innovations inc	94	207	45.4	IEEE	94	45.4	Joint IEEE and ACM	52	25.1
66	SPHERO INC	89	91	97.8	IEEE	89	97.8	American Automatic Control Council (AACC)	2	2.2
67	Canon Inc	87	197	44.2	IEEE	87	44.2	SPIE-Int Soc Opt Engineering	20	10.2
68	University of California	87	134	64.9	IEEE	87	64.9	RELX Group (Elsevier)	9	6.7
69	3D Systems Corp.	85	207	41.1	IEEE	85	41.1	ACM-Assoc Comput Mach	40	19.3
70	Caterpillar Inc.	85	226	37.6	IEEE	85	37.6	SAE-Society of Automobile Engineers	35	15.5
71	HP Inc	85	207	41.1	IEEE	85	41.1	ACM-Assoc Comput Mach	26	12.6
72	NEURALA INC	83	120	69.2	IEEE	83	69.2	MIT Press	15	12.5
73	ALOFT MEDIA LLC	82	102	80.4	IEEE	82	80.4	ASCE-AMER SOC CIVIL ENGINEERS	6	5.9
74	ARCHI CON DES INVENTI	82	399	20.6	ACM-Assoc Comput Mach	125	31.3	IEEE	82	20.6
75	Toyota Motor Corp	82	177	46.3	IEEE	82	46.3	ACM-Assoc Comput Mach	18	10.2
76	Teradyne Inc.	81	181	44.8	IEEE	81	44.8	ASME-Am Soc Mech Eng	23	12.7
77	Sap SE	80	283	28.3	IEEE	80	28.3	ACM-Assoc Comput Mach	48	17.0
78	NEC Corp	77	150	51.3	IEEE	77	51.3	ACM-Assoc Comput Mach	12	8.0
79	Softbank Corp	77	163	47.2	IEEE	77	47.2	IEEE/RSJ	26	16.0
80	Rag Foundation	76	123	61.8	IEEE	76	61.8	RELX Group (Elsevier)	16	13.0

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Midea Group Co Ltd	74	101	73.3	IEEE	74	73.3	IEEE/RSJ	7	6.9
82	HURCO COMPANIES INC	72	167	43.1	IEEE	72	43.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	19	11.4
83	MKS Instruments Inc.	72	171	42.1	IEEE	72	42.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	27	15.8
84	University of South Florida	72	130	55.4	IEEE	72	55.4	ACM-Assoc Comput Mach	13	10.0
85	General Motors Corp	70	174	40.2	IEEE	70	40.2	RELX Group (Elsevier)	19	10.9
86	Health Discovery Corp	70	281	24.9	IEEE	70	24.9	IWDM Org	24	8.5
87	United Technologies Corp	69	121	57.0	IEEE	69	57.0	RELX Group (Elsevier)	12	9.9
88	AUREON LABORATORIES	67	273	24.5	IEEE	67	24.5	RELX Group (Elsevier)	35	12.8
89	Arizona State University	65	106	61.3	IEEE	65	61.3	RELX Group (Elsevier)	7	6.6
90	Harvard University	64	157	40.8	IEEE	64	40.8	IEEE/RSJ	23	14.6
91	Oracle Corporation	64	120	53.3	IEEE	64	53.3	ACM-Assoc Comput Mach	17	14.2
92	Procter & Gamble Co.	64	117	54.7	IEEE	64	54.7	RELX Group (Elsevier)	13	11.1
93	Brooks Automation Inc.	60	130	46.2	IEEE	60	46.2	RELX Group (Elsevier)	11	8.5
94	TEST ADVANTAGE INC	60	71	84.5	IEEE	60	84.5	SPIE-Int Soc Opt Engineering	4	5.6
95	Ford Motor Co.	59	151	39.1	IEEE	59	39.1	Winter Simulation Conference Board of Directors	24	15.9
96	Georgia Institute of Technolo	59	115	51.3	IEEE	59	51.3	American Automatic Control Council (AACC)	22	19.1
97	Nokia Corp	59	97	60.8	IEEE	59	60.8	ACM-Assoc Comput Mach	7	7.2
98	Texas Instruments Inc	59	113	52.2	IEEE	59	52.2	Penton/IPC, Inc.	13	11.5
99	United States Navy	59	105	56.2	IEEE	59	56.2	IEEE/RSJ	8	7.6
100	Ecole Polytechnique Federale	58	87	66.7	IEEE	58	66.7	IEEE/RSJ	6	6.9

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Semiconductors/Solid-State Devices/Electronics</i>										
1	Micron Technology Inc.	24267	86392	28.1	IEEE	24267	28.1	RELX Group (Elsevier)	15533	18.0
2	Semiconductor Energy Labor	11770	1E+05	9.7	SID-Society for Information Display	35112	29.0	American Institute of Physics	24357	20.1
3	MONOLITHIC 3D INC	9768	16701	58.5	IEEE	9768	58.5	IEEE/JPN Soc App Phys	1841	11.0
4	International Business Machi	9267	20980	44.2	IEEE	9267	44.2	American Institute of Physics	3289	15.7
5	Taiwan Semiconductor Manu	7601	22491	33.8	IEEE	7601	33.8	American Institute of Physics	7086	31.5
6	Tela Innovations inc	4763	14997	31.8	SPIE-Int Soc Opt Engineering	5066	33.8	IEEE	4763	31.8
7	Macronix International Co. Lt	4628	8797	52.6	IEEE	4628	52.6	IEEE/JPN Soc App Phys	1668	19.0
8	Intel Corporation	4466	8420	53.0	IEEE	4466	53.0	American Institute of Physics	991	11.8
9	Cree Inc.	4117	11195	36.8	IEEE	4117	36.8	American Institute of Physics	2555	22.8
10	Western Digital Corp.	3825	7675	49.8	IEEE	3825	49.8	American Institute of Physics	974	12.7
11	Qorvo	3734	4368	85.5	IEEE	3734	85.5	American Institute of Physics	319	7.3
12	Chipbond Technology Corp	2885	3613	79.9	IEEE	2885	79.9	RELX Group (Elsevier)	266	7.4
13	Infineon Technologies AG	2682	5348	50.1	IEEE	2682	50.1	American Institute of Physics	772	14.4
14	On Semiconductor Corporati	2624	3583	73.2	IEEE	2624	73.2	RELX Group (Elsevier)	277	7.7
15	NXP Semiconductors NV	2478	4983	49.7	IEEE	2478	49.7	American Institute of Physics	790	15.9
16	Texas Instruments Inc	2368	4210	56.2	IEEE	2368	56.2	American Institute of Physics	441	10.5
17	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
18	Applied Materials Inc.	2208	12565	17.6	American Institute of Physics	2799	22.3	IEEE	2208	17.6
19	University of Illinois	2193	19213	11.4	American Institute of Physics	4697	24.4	ACS-Am Chem Soc	2800	14.6
20	Broadcom Ltd	2159	6321	34.2	IEEE	2159	34.2	SMTA-Surface Mount Technology Association	1017	16.1
21	Toshiba Corp	2106	5300	39.7	IEEE	2106	39.7	American Institute of Physics	866	16.3
22	Murata Manufacturing Co. Lt	1935	2665	72.6	IEEE	1935	72.6	American Institute of Physics	106	4.0
23	PDF Solutions	1750	2233	78.4	IEEE	1750	78.4	SPIE-Int Soc Opt Engineering	343	15.4
24	Global Foundries Inc	1546	2958	52.3	IEEE	1546	52.3	American Institute of Physics	430	14.5
25	Advanced Micro Devices Inc	1543	2912	53.0	IEEE	1543	53.0	American Institute of Physics	310	10.6
26	STMicroelectronics	1427	3207	44.5	IEEE	1427	44.5	RELX Group (Elsevier)	452	14.1
27	Samsung Electronics Co Ltd	1320	6603	20.0	American Institute of Physics	1408	21.3	IEEE	1320	20.0
28	Renesas Electronic Corporati	1318	2366	55.7	IEEE	1318	55.7	IEEE/JPN Soc App Phys	294	12.4
29	University of California	1297	13556	9.6	American Institute of Physics	3668	27.1	RELX Group (Elsevier)	1789	13.2
30	California Institute of Techno	1266	7212	17.6	IEEE	1266	17.6	American Institute of Physics	1198	16.6
31	Qualcomm Inc	1243	2463	50.5	IEEE	1243	50.5	American Institute of Physics	216	8.8
32	ASM International N.V.	1179	8181	14.4	American Institute of Physics	2026	24.8	RELX Group (Elsevier)	1601	19.6
33	II-VI Inc	1179	3481	33.9	IEEE	1179	33.9	American Institute of Physics	647	18.6
34	Xperi Corporation (Formerly	1155	3319	34.8	IEEE	1155	34.8	American Institute of Physics	819	24.7
35	Transphorm Inc	1153	2241	51.5	IEEE	1153	51.5	American Institute of Physics	441	19.7
36	Panasonic Corporation	1065	4828	22.1	IEEE	1065	22.1	American Institute of Physics	890	18.4
37	Massachusetts Institute of Te	1003	6766	14.8	American Institute of Physics	1525	22.5	IEEE	1003	14.8
38	Motorola Solutions Inc.	997	3181	31.3	IEEE	997	31.3	American Institute of Physics	811	25.5
39	HRL Laboratories LLC	987	1977	49.9	IEEE	987	49.9	American Institute of Physics	363	18.4

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Cypress Semiconductor Corp.	984	1562	63.0	IEEE	984	63.0	American Institute of Physics	117	7.5
41	Commissariat A L'Energie At	983	4968	19.8	American Institute of Physics	1169	23.5	IEEE	983	19.8
42	United Microelectronics Corp	926	1797	51.5	IEEE	926	51.5	American Institute of Physics	280	15.6
43	ZENO SEMICONDUCTOR I	874	1127	77.6	IEEE	874	77.6	IEEE/JPN Soc App Phys	195	17.3
44	Synopsys Inc.	820	1759	46.6	IEEE	820	46.6	American Institute of Physics	311	17.7
45	Mitsubishi Electric Corp	812	1638	49.6	IEEE	812	49.6	American Institute of Physics	154	9.4
46	Fujitsu Limited	733	2268	32.3	IEEE	733	32.3	American Institute of Physics	328	14.5
47	NEC Corp	716	1997	35.9	IEEE	716	35.9	American Institute of Physics	345	17.3
48	Lam Research Corp.	712	4085	17.4	American Institute of Physics	1161	28.4	IEEE	712	17.4
49	Crossbar Inc	696	2348	29.6	IEEE	696	29.6	American Institute of Physics	350	14.9
50	Hon Hai Precision Industry C	674	3458	19.5	American Institute of Physics	917	26.5	IEEE	674	19.5
51	Hitachi Ltd	633	2157	29.3	IEEE	633	29.3	American Institute of Physics	426	19.7
52	Analog Devices Inc.	606	918	66.0	IEEE	606	66.0	RELX Group (Elsevier)	66	7.2
53	Unisantis Electronics Ltd	589	690	85.4	IEEE	589	85.4	RELX Group (Elsevier)	36	5.2
54	Michigan State University	546	6965	7.8	Optical Society of America	1527	21.9	American Institute of Physics	1090	15.6
55	Mevion Medical Systems Inc	527	1952	27.0	IEEE	527	27.0	RELX Group (Elsevier)	388	19.9
56	Thermo Fisher Scientific Inc	527	2482	21.2	RELX Group (Elsevier)	794	32.0	IEEE	527	21.2
57	SK Hynix Inc	515	1014	50.8	IEEE	515	50.8	American Institute of Physics	121	11.9
58	Industrial Technology Researc	511	1508	33.9	IEEE	511	33.9	RELX Group (Elsevier)	242	16.0
59	Apple Inc	508	1221	41.6	IEEE	508	41.6	American Institute of Physics	190	15.6
60	Hong Kong University of Sci	502	938	53.5	IEEE	502	53.5	American Institute of Physics	204	21.7
61	Interuniversity MicroElectron	490	1495	32.8	IEEE	490	32.8	American Institute of Physics	268	17.9
62	Aisin Seiki Co. Ltd.	477	3255	14.7	Optical Society of America	1174	36.1	IEEE	477	14.7
63	Nokia Corp	468	2515	18.6	American Institute of Physics	516	20.5	IEEE	468	18.6
64	Nantero Inc	464	7057	6.6	ACS-Am Chem Soc	2087	29.6	American Institute of Physics	1547	21.9
65	AMS AG	462	3042	15.2	American Institute of Physics	870	28.6	IEEE	462	15.2
66	Soraa Inc	459	5321	8.6	American Institute of Physics	1807	34.0	Institute of Pure and Applied Physics	911	17.1
67	Innovative Silicon SA	453	556	81.5	IEEE	453	81.5	RELX Group (Elsevier)	24	4.3
68	Power Integrations Inc.	449	667	67.3	IEEE	449	67.3	Institute of Pure and Applied Physics	59	8.8
69	Maxim Integrated Products In	448	551	81.3	IEEE	448	81.3	Joint IEEE and ACM	19	3.4
70	Sulvolta Inc	448	930	48.2	IEEE	448	48.2	American Institute of Physics	139	14.9
71	Electronics and Telecommuni	436	1238	35.2	IEEE	436	35.2	American Institute of Physics	271	21.9
72	Partners HealthCare Systems	432	6064	7.1	Optical Society of America	2222	36.6	RELX Group (Elsevier)	833	13.7
73	United States Navy	403	2090	19.3	American Institute of Physics	613	29.3	IEEE	403	19.3
74	Sony Corp	393	1782	22.1	IEEE	393	22.1	American Institute of Physics	376	21.1
75	Xerox Corp	393	2219	17.7	American Institute of Physics	633	28.5	IEEE	393	17.7
76	Lockheed Martin Corp.	387	2136	18.1	American Institute of Physics	466	21.8	IEEE	387	18.1
77	Canon Inc	381	3482	10.9	American Institute of Physics	852	24.5	RELX Group (Elsevier)	500	14.4
78	General Electric Company	381	1396	27.3	IEEE	381	27.3	American Institute of Physics	243	17.4
79	ACORN TECHNOLOGIES I	380	1423	26.7	American Institute of Physics	516	36.3	IEEE	380	26.7
80	University of Wisconsin	378	1543	24.5	American Institute of Physics	467	30.3	IEEE	378	24.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	SolAero Technologies Corp	376	566	66.4	IEEE	376	66.4	American Institute of Physics	91	16.1
82	Xtera Communications Inc.	375	1111	33.8	IEEE	375	33.8	Optical Society of America	263	23.7
83	Georgia Institute of Technolo	367	1101	33.3	IEEE	367	33.3	American Institute of Physics	157	14.3
84	Vishay Intertechnology Inc.	367	542	67.7	IEEE	367	67.7	RELX Group (Elsevier)	33	6.1
85	Soitec SA	356	1828	19.5	American Institute of Physics	504	27.6	IEEE	356	19.5
86	Jiangsu ChangJiang Electroni	353	445	79.3	IEEE	353	79.3	International Microelectronics And Packaging Society	40	9.0
87	Siemens Aktiengesellschaft	352	1038	33.9	IEEE	352	33.9	American Institute of Physics	170	16.4
88	TDK Corporation	340	1287	26.4	IEEE	340	26.4	American Institute of Physics	331	25.7
89	Total SA	340	590	57.6	IEEE	340	57.6	WIP-Renewable Energies	55	9.3
90	Viavi Solutions Inc	336	965	34.8	IEEE	336	34.8	American Institute of Physics	302	31.3
91	Silicon Genesis Corporation	335	1616	20.7	IEEE	335	20.7	RELX Group (Elsevier)	328	20.3
92	Microchip Technology Inc.	332	532	62.4	IEEE	332	62.4	American Institute of Physics	33	6.2
93	Seoul Semiconductor Co Ltd	325	2461	13.2	American Institute of Physics	1064	43.2	IEEE	325	13.2
94	Columbia University	324	4078	7.9	American Institute of Physics	1521	37.3	MRS-Materials Research Soc	436	10.7
95	Seiko Epson Corporation	323	1403	23.0	IEEE	323	23.0	American Institute of Physics	263	18.7
96	University of Michigan	322	1575	20.4	American Institute of Physics	388	24.6	IEEE	322	20.4
97	Sanken Electric Co. Ltd.	321	414	77.5	IEEE	321	77.5	American Institute of Physics	41	9.9
98	Bosch (Robert) GmbH	318	554	57.4	IEEE	318	57.4	RELX Group (Elsevier)	93	16.8
99	SiOnyx Inc	316	1551	20.4	American Institute of Physics	584	37.7	IEEE	316	20.4
100	Sanan Optoelectronics Techn	315	1256	25.1	American Institute of Physics	561	44.7	IEEE	315	25.1

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Smart Grid/Smart Meters/Energy Infrastructure</i>										
1	Velatia Group	839	1099	76.3	IEEE	839	76.3	Echelon Corp	81	7.4
2	SolarEdge Technologies Inc	611	672	90.9	IEEE	611	90.9	WIP-Renewable Energies	20	3.0
3	Honeywell International Inc.	234	284	82.4	IEEE	234	82.4	American Library Association	12	4.2
4	TRILLIANT NETWORKS IN	227	320	70.9	IEEE	227	70.9	Internet Soc/IETF-Internet Eng Task Force	18	5.6
5	SIPCO LLC	156	270	57.8	IEEE	156	57.8	Internet Soc/IETF-Internet Eng Task Force	27	10.0
6	General Electric Company	133	184	72.3	IEEE	133	72.3	RELX Group (Elsevier)	9	4.9
7	ABB Ltd	129	152	84.9	IEEE	129	84.9	IET/IEE	7	4.6
8	Battelle Memorial Institute	107	146	73.3	IEEE	107	73.3	RELX Group (Elsevier)	8	5.5
9	California Institute of Techno	106	110	96.4	IEEE	106	96.4	American Automatic Control Council (AACC)	3	2.7
10	Alstom	69	81	85.2	IEEE	69	85.2	IET/IEE	8	9.9
11	AMPT LLC	63	68	92.6	IEEE	63	92.6	IET/IEE	4	5.9
12	International Business Machi	63	94	67.0	IEEE	63	67.0	ACM-Assoc Comput Mach	6	6.4
13	ASTROLINK INTERNATIO	59	67	88.1	IEEE	59	88.1	IET/IEE	6	9.0
14	DOMINION ENERGY TEC	59	67	88.1	IEEE	59	88.1	IET/IEE	6	9.0
15	SOLAREEDGE TECHNOLO	55	68	80.9	IEEE	55	80.9	WIP-Renewable Energies	7	10.3
16	Itron Inc.	48	81	59.3	IEEE	48	59.3	ACM-Assoc Comput Mach	11	13.6
17	SMART WIRES INC	48	52	92.3	IEEE	48	92.3	ACM-Assoc Comput Mach	4	7.7
18	Qualcomm Inc	44	74	59.5	IEEE	44	59.5	3GPP General Partnership Project Standards Body	10	13.5
19	3M Co	40	48	83.3	IEEE	40	83.3	AIAA-Am Inst Aero Astro	3	6.3
20	University of Minnesota (The	36	36	100.0	IEEE	36	100.0			
21	Siemens Aktiengesellschaft	33	59	55.9	IEEE	33	55.9	United Business Media/UBM Tech	11	18.6
22	Witricity Corp	33	37	89.2	IEEE	33	89.2	American Institute of Physics	3	8.1
23	Hubbell Inc.	31	33	93.9	IEEE	31	93.9	Multidisciplinary Digital Publishing Institute (MDPI)	1	3.0
24	Microsoft Corporation	31	63	49.2	IEEE	31	49.2	ACM-Assoc Comput Mach	11	17.5
25	Total SA	31	36	86.1	IEEE	31	86.1	EPE Association	4	11.1
26	University of Maryland	30	30	100.0	IEEE	30	100.0			
27	Georgia Institute of Technolo	28	83	33.7	ACM-Assoc Comput Mach	47	56.6	IEEE	28	33.7
28	Rockwell Automation Inc	27	37	73.0	IEEE	27	73.0	IET/IEE	3	8.1
29	ENERGY TECHNOLOGY G	26	30	86.7	IEEE	26	86.7	ACM-Assoc Comput Mach	2	6.7
30	Schweitzer Engineering Labo	25	26	96.2	IEEE	25	96.2	IEC-International Electrotechnical Commission	1	3.8
31	Tigo Energy Inc	24	32	75.0	IEEE	24	75.0	WIP-Renewable Energies	6	18.8
32	SPARQ SYSTEMS INC	23	29	79.3	IEEE	23	79.3	RELX Group (Elsevier)	3	10.3
33	LSIS Co Ltd (Formerly LS In	22	26	84.6	IEEE	22	84.6	IET/IEE	3	11.5
34	Taiwan Semiconductor Manu	21	39	53.8	IEEE	21	53.8	Electrostatic Discharge Association	15	38.5
35	Schneider Electric S.A.	20	103	19.4	ANSI-American National Standards Institute	27	26.2	IEEE	20	19.4
36	TEMPORAL POWER LTD	20	20	100.0	IEEE	20	100.0			
37	ConvergeOne Inc	19	22	86.4	IEEE	19	86.4	Internet Soc/IETF-Internet Eng Task Force	2	9.1
38	Commscope Inc.	18	18	100.0	IEEE	18	100.0			
39	Mitsubishi Electric Corp	18	19	94.7	IEEE	18	94.7	Hindawi Publishing Corporation	1	5.3

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	New Jersey Institute of Techn	17	17	100.0	IEEE	17	100.0			
41	Massachusetts Institute of Te	16	22	72.7	IEEE	16	72.7	AMER SOC NAVAL ENG INC	4	18.2
42	Electro Industries Gauge Tec	14	26	53.8	IEEE	14	53.8	ACM-Assoc Comput Mach	7	26.9
43	Accenture Ltd.	13	18	72.2	IEEE	13	72.2	A B B Corporate Management Services AG	4	22.2
44	Sony Corp	13	45	28.9	SID-Society for Information Display	24	53.3	IEEE	13	28.9
45	AT&T Inc	12	15	80.0	IEEE	12	80.0	ACM-Assoc Comput Mach	1	6.7
46	DELTA ENERGY & COMM	12	15	80.0	IEEE	12	80.0	ACM-Assoc Comput Mach	3	20.0
47	Panasonic Corporation	12	15	80.0	IEEE	12	80.0	IEICE-Inst Elec Info Comm Eng	2	13.3
48	Google Inc.	11	19	57.9	IEEE	11	57.9	ACM-Assoc Comput Mach	1	5.3
49	THE DETROIT EDISON CO	11	11	100.0	IEEE	11	100.0			
50	Eaton Corp.	10	14	71.4	IEEE	10	71.4	IET/IEE	2	14.3
51	Elwha LLC	10	18	55.6	IEEE	10	55.6	RELX Group (Elsevier)	3	16.7
52	Enphase Energy Inc	10	10	100.0	IEEE	10	100.0			
53	Nokia Corp	10	17	58.8	IEEE	10	58.8	Joint IEEE and ACM	2	11.8
54	Roche Holding Ltd.	10	10	100.0	IEEE	10	100.0			
55	Signify NV	10	11	90.9	IEEE	10	90.9	IEEE/OSA	1	9.1
56	THE FLORIDA INTERNATI	10	13	76.9	IEEE	10	76.9	Joint IEEE and ACM	2	15.4
57	Cisco Systems Inc.	9	14	64.3	IEEE	9	64.3	Internet Soc/IETF-Internet Eng Task Force	5	35.7
58	Hon Hai Precision Industry C	9	33	27.3	ACM-Assoc Comput Mach	16	48.5	IEEE	9	27.3
59	INTERNATIONAL BROAD	9	17	52.9	IEEE	9	52.9	ISO-International Standards Organization	6	35.3
60	STEM INC	9	9	100.0	IEEE	9	100.0			
61	University of Missouri	9	10	90.0	IEEE	9	90.0	Summit Technical Media	1	10.0
62	University of Texas	9	14	64.3	IEEE	9	64.3	American Institute of Physics	4	28.6
63	University of Wisconsin	9	10	90.0	IEEE	9	90.0	MONTANA HISTORICAL SOC	1	10.0
64	Energous Corporation	8	10	80.0	IEEE	8	80.0	Rajagiri School of Engineering & Technology, Cochin, Kerala,	1	10.0
65	NORWEB PLC	8	19	42.1	IEEE	8	42.1	PennWell Publishing Co.	4	21.1
66	The Invention Science Fund I	8	15	53.3	IEEE	8	53.3	ANSI-American National Standards Institute	4	26.7
67	Clemson University	7	9	77.8	IEEE	7	77.8	American Institute of Physics	1	11.1
68	CURRENT GRID LLC	7	11	63.6	IEEE	7	63.6	Echelon Corp	2	18.2
69	CURRENT TECHNOLOGIE	7	12	58.3	IEEE	7	58.3	Hewlett-Packard Company	2	16.7
70	Danfoss A/S	7	7	100.0	IEEE	7	100.0			
71	Nth Degree Technologies Wo	7	13	53.8	IEEE	7	53.8	American Institute of Physics	6	46.2
72	POWER TAGGING TECHN	7	8	87.5	IEEE	7	87.5	IET/IEE	1	12.5
73	STMicronics	7	12	58.3	IEEE	7	58.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3	25.0
74	TACTILIS SDN BHD	7	7	100.0	IEEE	7	100.0			
75	Toshiba Corp	7	12	58.3	IEEE	7	58.3	Internet Soc/IETF-Internet Eng Task Force	2	16.7
76	UNIVERSITI BRUNEI DAR	7	8	87.5	IEEE	7	87.5	RELX Group (Elsevier)	1	12.5
77	University of California	7	8	87.5	IEEE	7	87.5	Institution of Engineering and Technology	1	12.5
78	Boeing Co. (The)	6	12	50.0	IEEE	6	50.0	TMS-Minerals Metals Materials Soc	1	8.3
79	Digimarc Corp.	6	6	100.0	IEEE	6	100.0			
80	EMPOWER MICRO SYSTE	6	6	100.0	IEEE	6	100.0			

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	King Fahd University of Petr	6	9	66.7	IEEE	6	66.7	United Business Media/UBM Tech	3	33.3
82	Oracle Corporation	6	6	100.0	IEEE	6	100.0			
83	TAE TECHNOLOGIES INC	6	108	5.6	American Institute of Physics	43	39.8	American Physical Society	21	19.4
84	University of Oxford	6	6	100.0	IEEE	6	100.0			
85	UT-Battelle LLC	6	68	8.8	Electrochemical Society, Inc.	23	33.8	RELX Group (Elsevier)	22	32.4
86	Vestas Wind Systems A/S	6	8	75.0	IEEE	6	75.0	IEC-International Electrotechnical Commission	1	12.5
87	Wayne State University (Detr	6	6	100.0	IEEE	6	100.0			
88	Xtrion NV	6	10	60.0	IEEE	6	60.0	American Institute of Physics	3	30.0
89	Adient PLC	5	5	100.0	IEEE	5	100.0			
90	Bosch (Robert) GmbH	5	6	83.3	IEEE	5	83.3	American Institute of Physics	1	16.7
91	Broadcom Ltd	5	6	83.3	IEEE	5	83.3	IET/IEE	1	16.7
92	COM/ENERGY TECHNOL	5	16	31.3	RELX Group (Elsevier)	6	37.5	IEEE	5	31.3
93	DGI CREATIONS LLC	5	5	100.0	IEEE	5	100.0			
94	D-Wave Systems Inc.	5	29	17.2	American Physical Society	9	31.0	IEEE	5	17.2
95	Electric Power Research Insti	5	11	45.5	Electric Power Research Institute	6	54.5	IEEE	5	45.5
96	Korea Electrotechnology Res	5	5	100.0	IEEE	5	100.0			
97	On Semiconductor Corporati	5	5	100.0	IEEE	5	100.0			
98	Samsung Electronics Co Ltd	5	19	26.3	IEEE	5	26.3	ACS-Am Chem Soc	3	15.8
99	State University of New York	5	6	83.3	IEEE	5	83.3	RELX Group (Elsevier)	1	16.7
100	University of Alberta	5	8	62.5	IEEE	5	62.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1	12.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Solar/Photovoltaic</i>										
1	SolarEdge Technologies Inc	1822	2077	87.7	IEEE	1822	87.7	WIP-Renewable Energies	119	5.7
2	Total SA	484	753	64.3	IEEE	484	64.3	WIP-Renewable Energies	59	7.8
3	SolAero Technologies Corp	392	586	66.9	IEEE	392	66.9	American Institute of Physics	93	15.9
4	University of Illinois	381	3437	11.1	American Institute of Physics	822	23.9	ACS-Am Chem Soc	562	16.4
5	Tigo Energy Inc	338	450	75.1	IEEE	338	75.1	WIP-Renewable Energies	84	18.7
6	AMPT LLC	318	361	88.1	IEEE	318	88.1	IET/IEE	20	5.5
7	Taiwan Semiconductor Manu	272	1072	25.4	American Institute of Physics	474	44.2	IEEE	272	25.4
8	Sanan Optoelectronics Techn	258	610	42.3	IEEE	258	42.3	US Dept of Energy	246	40.3
9	Emcore Corp.	247	489	50.5	IEEE	247	50.5	US Dept of Energy	76	15.5
10	International Business Machi	241	955	25.2	IEEE	241	25.2	American Institute of Physics	200	20.9
11	Xtrion NV	157	882	17.8	American Institute of Physics	305	34.6	IEEE	157	17.8
12	Xerox Corp	152	491	31.0	IEEE	152	31.0	RELX Group (Elsevier)	93	18.9
13	SEMPRIUS INC	150	1692	8.9	American Institute of Physics	319	18.9	ACS-Am Chem Soc	307	18.1
14	California Institute of Techno	139	589	23.6	American Institute of Physics	183	31.1	IEEE	139	23.6
15	Hanergy Holding Group Ltd	135	396	34.1	IEEE	135	34.1	American Institute of Physics	74	18.7
16	Beamreach Solar Inc	132	558	23.7	RELX Group (Elsevier)	180	32.3	IEEE	132	23.7
17	Solar Junction Corp	126	550	22.9	American Institute of Physics	193	35.1	IEEE	126	22.9
18	Enphase Energy Inc	111	120	92.5	IEEE	111	92.5	IET/IEE	4	3.3
19	Tesla Motors Inc	104	140	74.3	IEEE	104	74.3	WIP-Renewable Energies	8	5.7
20	Alliance for Sustainable Ener	87	598	14.5	American Institute of Physics	166	27.8	RELX Group (Elsevier)	112	18.7
21	Advanced Energy Industries I	84	91	92.3	IEEE	84	92.3	IET/IEE	4	4.4
22	Lockheed Martin Corp.	80	287	27.9	IEEE	80	27.9	American Institute of Physics	63	22.0
23	Applied Materials Inc.	79	241	32.8	IEEE	79	32.8	WIP-Renewable Energies	51	21.2
24	Massachusetts Institute of Te	79	357	22.1	IEEE	79	22.1	American Institute of Physics	60	16.8
25	Stion Corp	77	671	11.5	RELX Group (Elsevier)	225	33.5	American Institute of Physics	146	21.8
26	Canon Inc	76	200	38.0	IEEE	76	38.0	American Institute of Physics	34	17.0
27	Witricity Corp	71	106	67.0	IEEE	71	67.0	American Institute of Physics	9	8.5
28	TESLA INC	70	163	42.9	IEEE	70	42.9	American Institute of Physics	49	30.1
29	Solyndra Inc	68	361	18.8	RELX Group (Elsevier)	117	32.4	IEEE	68	18.8
30	Nanosolar Inc	61	873	7.0	RELX Group (Elsevier)	248	28.4	Electrochemical Society, Inc.	107	12.3
31	Boeing Co. (The)	60	157	38.2	IEEE	60	38.2	RELX Group (Elsevier)	26	16.6
32	First Solar Inc	57	229	24.9	RELX Group (Elsevier)	93	40.6	IEEE	57	24.9
33	Texas Instruments Inc	57	68	83.8	IEEE	57	83.8	Electrochemical Society, Inc.	4	5.9
34	LG Electronics Inc.	54	158	34.2	IEEE	54	34.2	American Institute of Physics	38	24.1
35	CLEAN POWER RESEARC	52	94	55.3	IEEE	52	55.3	RELX Group (Elsevier)	31	33.0
36	General Electric Company	52	311	16.7	ACS-Am Chem Soc	83	26.7	IEEE	52	16.7
37	ZENA TECHNOLOGIES IN	49	120	40.8	IEEE	49	40.8	American Institute of Physics	35	29.2
38	Dartmouth College	48	60	80.0	IEEE	48	80.0	RELX Group (Elsevier)	4	6.7
39	Hon Hai Precision Industry C	47	197	23.9	IEEE	47	23.9	RELX Group (Elsevier)	36	18.3

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	SUNIVA INC	45	88	51.1	IEEE	45	51.1	WIP-Renewable Energies	12	13.6
41	Ignis Innovation Inc	43	55	78.2	IEEE	43	78.2	SID-Society for Information Display	8	14.5
42	United States Navy	43	157	27.4	IEEE	43	27.4	American Institute of Physics	27	17.2
43	JXTG Holdings Inc	40	132	30.3	IEEE	40	30.3	RELX Group (Elsevier)	30	22.7
44	Azur Space Solar Power Gmb	39	93	41.9	IEEE	39	41.9	RELX Group (Elsevier)	21	22.6
45	Arizona State University	37	184	20.1	American Institute of Physics	47	25.5	IEEE	37	20.1
46	University of Toledo	37	142	26.1	RELX Group (Elsevier)	82	57.7	IEEE	37	26.1
47	University of Minnesota (The	36	92	39.1	IEEE	36	39.1	American Institute of Physics	25	27.2
48	APOLLO PRECISION FUJI	35	47	74.5	IEEE	35	74.5	RELX Group (Elsevier)	5	10.6
49	EVERGREEN SOLAR INC	35	73	47.9	IEEE	35	47.9	ACS-Am Chem Soc	34	46.6
50	Ostendo Technologies Inc	35	89	39.3	IEEE	35	39.3	RELX Group (Elsevier)	23	25.8
51	Panasonic Corporation	35	206	17.0	American Institute of Physics	56	27.2	RELX Group (Elsevier)	38	18.4
52	4POWER LLC	34	66	51.5	IEEE	34	51.5	American Institute of Physics	18	27.3
53	Commissariat A L'Energie At	34	207	16.4	RELX Group (Elsevier)	85	41.1	IEEE	34	16.4
54	University of California	33	695	4.7	American Institute of Physics	121	17.4	ACS-Am Chem Soc	116	16.7
55	Semiconductor Energy Labor	31	430	7.2	SID-Society for Information Display	151	35.1	American Institute of Physics	80	18.6
56	DuPont de Nemours Inc.	29	197	14.7	RELX Group (Elsevier)	66	33.5	IEEE	29	14.7
57	AMI RESAERCH & DEVEL	27	65	41.5	IEEE	27	41.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	12.3
58	Koch Industries Inc	27	309	8.7	RELX Group (Elsevier)	120	38.8	American Institute of Physics	83	26.9
59	GTAT Corp (AT Advanced T	26	126	20.6	IEEE	26	20.6	American Institute of Physics	25	19.8
60	Teijin Ltd.	26	68	38.2	IEEE	26	38.2	WIP-Renewable Energies	11	16.2
61	The National Aeronautical an	26	194	13.4	MacMillan Publishing Company	29	14.9	IEEE	26	13.4
62	Hanwha Group	25	67	37.3	IEEE	25	37.3	American Institute of Physics	18	26.9
63	Imperial College	25	81	30.9	IEEE	25	30.9	American Institute of Physics	23	28.4
64	Industrial Technology Researc	25	165	15.2	RELX Group (Elsevier)	46	27.9	IEEE	25	15.2
65	Compagnie de Saint-Gobain	24	145	16.6	SPIE-Int Soc Opt Engineering	40	27.6	RELX Group (Elsevier)	31	21.4
66	Fraunhofer Gesellschaft	24	86	27.9	IEEE	24	27.9	RELX Group (Elsevier)	19	22.1
67	Interuniversity MicroElectron	23	101	22.8	IEEE	23	22.8	RELX Group (Elsevier)	22	21.8
68	NATIONAL TECHNOLOGY	23	39	59.0	IEEE	23	59.0	ACS-Am Chem Soc	7	17.9
69	Precursor Energetics Inc	23	1095	2.1	ACS-Am Chem Soc	481	43.9	RELX Group (Elsevier)	237	21.6
70	Qualcomm Inc	23	66	34.8	IEEE	23	34.8	SID-Society for Information Display	11	16.7
71	Shin-Etsu Chemical Co. Ltd.	23	58	39.7	IEEE	23	39.7	RELX Group (Elsevier)	9	15.5
72	Solopower Inc	23	211	10.9	RELX Group (Elsevier)	101	47.9	American Institute of Physics	43	20.4
73	University of Michigan	23	267	8.6	American Institute of Physics	75	28.1	ACS-Am Chem Soc	41	15.4
74	Mitsubishi Electric Corp	22	47	46.8	IEEE	22	46.8	WIP-Renewable Energies	8	17.0
75	Nth Degree Technologies Wo	22	167	13.2	MacMillan Publishing Company	29	17.4	IEEE	22	13.2
76	AT&T Inc	21	40	52.5	IEEE	21	52.5	American Institute of Physics	5	12.5
77	City University of Hong Kon	21	38	55.3	IEEE	21	55.3	IET/IEE	12	31.6
78	Toyota Motor Corp	21	74	28.4	IEEE	21	28.4	RELX Group (Elsevier)	16	21.6
79	INDIVIDUAL PATENTER	20	131	15.3	American Institute of Physics	23	17.6	IEEE	20	15.3
80	Toshiba Corp	19	123	15.4	ACS-Am Chem Soc	25	20.3	IEEE	19	15.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	ATHENAEUM LLC	18	104	17.3	RELX Group (Elsevier)	30	28.8	American Institute of Physics	18	17.3
82	Ebara Corp.	18	33	54.5	IEEE	18	54.5	RELX Group (Elsevier)	7	21.2
83	Laird Ltd	18	63	28.6	IEEE	18	28.6	American Institute of Physics	16	25.4
84	Midwest Research Institute	18	74	24.3	RELX Group (Elsevier)	21	28.4	IEEE	18	24.3
85	New Jersey Institute of Techn	18	24	75.0	IEEE	18	75.0	RELX Group (Elsevier)	3	12.5
86	ASCENT SOLAR TECHNO	17	43	39.5	IEEE	17	39.5	RELX Group (Elsevier)	11	25.6
87	Siemens Aktiengesellschaft	17	38	44.7	IEEE	17	44.7	RELX Group (Elsevier)	11	28.9
88	SMA Solar Technology AG	17	18	94.4	IEEE	17	94.4	IET/IEE	1	5.6
89	United States of America Dep	17	75	22.7	IEEE	17	22.7	RELX Group (Elsevier)	17	22.7
90	1366 TECHNOLOGIES INC	16	90	17.8	RELX Group (Elsevier)	47	52.2	IEEE	16	17.8
91	Catholic University Leuven	16	45	35.6	IEEE	16	35.6	RELX Group (Elsevier)	10	22.2
92	China National Chemical Cor	16	26	61.5	IEEE	16	61.5	WIP-Renewable Energies	4	15.4
93	Hitachi Ltd	16	52	30.8	IEEE	16	30.8	RELX Group (Elsevier)	11	21.2
94	PLANT PV INC	16	41	39.0	IEEE	16	39.0	RELX Group (Elsevier)	8	19.5
95	Rensselaer Polytechnic Instit	16	39	41.0	IEEE	16	41.0	American Institute of Physics	12	30.8
96	VERLIY LIFE SCIENCES L	16	17	94.1	IEEE	16	94.1	IEEE/OSA	1	5.9
97	BEIJING APOLLO DING R	15	42	35.7	IEEE	15	35.7	American Institute of Physics	11	26.2
98	Fujitsu Limited	15	25	60.0	IEEE	15	60.0	RELX Group (Elsevier)	5	20.0
99	Intevac Inc	15	72	20.8	American Institute of Physics	24	33.3	IEEE	15	20.8
100	Solfocus Inc	15	59	25.4	IEEE	15	25.4	RELX Group (Elsevier)	15	25.4

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<i>Telecom and Other Communications</i>										
1	Qualcomm Inc	27257	67311	40.5	IEEE	27257	40.5	3GPP General Partnership Project Standards Body	17021	25.3
2	AT&T Inc	25958	43885	59.2	IEEE	25958	59.2	ACM-Assoc Comput Mach	2108	4.8
3	Marvell Technology Group Lt	20992	26092	80.5	IEEE	20992	80.5	3GPP General Partnership Project Standards Body	3059	11.7
4	Broadcom Ltd	18457	27822	66.3	IEEE	18457	66.3	International Telecommunication Union	1168	4.2
5	Microsoft Corporation	15751	34672	45.4	IEEE	15751	45.4	ACM-Assoc Comput Mach	5482	15.8
6	Nokia Corp	12309	32852	37.5	IEEE	12309	37.5	3GPP General Partnership Project Standards Body	9276	28.2
7	Intel Corporation	11642	24970	46.6	IEEE	11642	46.6	3GPP General Partnership Project Standards Body	7191	28.8
8	InterDigital Inc	11540	48370	23.9	3GPP General Partnership Project Standards B	31577	65.3	IEEE	11540	23.9
9	Ericsson	11444	38944	29.4	3GPP General Partnership Project Standards B	16851	43.3	IEEE	11444	29.4
10	ParkerVision Inc	9995	19638	50.9	IEEE	9995	50.9	IET/IEE	4600	23.4
11	Cisco Systems Inc.	9425	29978	31.4	IEEE	9425	31.4	Internet Soc/IETF-Internet Eng Task Force	4800	16.0
12	Samsung Electronics Co Ltd	7883	25077	31.4	3GPP General Partnership Project Standards B	11617	46.3	IEEE	7883	31.4
13	Huawei Technologies Compa	7531	29029	25.9	3GPP General Partnership Project Standards B	13345	46.0	IEEE	7531	25.9
14	International Business Machi	7449	18525	40.2	IEEE	7449	40.2	ACM-Assoc Comput Mach	2816	15.2
15	LG Electronics Inc.	6988	37304	18.7	3GPP General Partnership Project Standards B	22942	61.5	IEEE	6988	18.7
16	Personalized Media Commun	6865	40129	17.1	Society of Motion Picture and Television Engi	12172	30.3	IEEE	6865	17.1
17	Apple Inc	6555	13821	47.4	IEEE	6555	47.4	ACM-Assoc Comput Mach	1280	9.3
18	Sony Corp	6023	13965	43.1	IEEE	6023	43.1	3GPP General Partnership Project Standards Body	1935	13.9
19	REARDEN LLC	5659	6225	90.9	IEEE	5659	90.9	IET/IEE	192	3.1
20	Panasonic Corporation	5635	16083	35.0	IEEE	5635	35.0	3GPP General Partnership Project Standards Body	4884	30.4
21	Massachusetts Institute of Te	5604	9261	60.5	IEEE	5604	60.5	ACM-Assoc Comput Mach	442	4.8
22	Fractus SA	5313	8900	59.7	IEEE	5313	59.7	IET/IEE	1306	14.7
23	Google Inc.	4986	13096	38.1	IEEE	4986	38.1	ACM-Assoc Comput Mach	1561	11.9
24	Commscope Inc.	4857	7828	62.0	IEEE	4857	62.0	3GPP General Partnership Project Standards Body	433	5.5
25	Blackberry Ltd.	4364	17763	24.6	3GPP General Partnership Project Standards B	8748	49.2	IEEE	4364	24.6
26	Adaptix	4355	6332	68.8	IEEE	4355	68.8	European Telecom Standards Institute (ETSI)	683	10.8
27	Fujitsu Limited	4197	12004	35.0	IEEE	4197	35.0	3GPP General Partnership Project Standards Body	2811	23.4
28	Nippon Telegraph & Telepho	3956	12391	31.9	3GPP General Partnership Project Standards B	4429	35.7	IEEE	3956	31.9
29	Texas Instruments Inc	3894	5947	65.5	IEEE	3894	65.5	3GPP General Partnership Project Standards Body	543	9.1
30	Rambus Inc.	3649	5063	72.1	IEEE	3649	72.1	IEEE/JPN Soc App Phys	232	4.6
31	RPX Corp	3644	8516	42.8	IEEE	3644	42.8	IEEE/OSA	844	9.9
32	NEC Corp	3350	11661	28.7	3GPP General Partnership Project Standards B	4978	42.7	IEEE	3350	28.7
33	Xperi Corporation (Formerly	3246	5549	58.5	IEEE	3246	58.5	ACM-Assoc Comput Mach	555	10.0
34	Electronics and Telecommuni	3178	5720	55.6	IEEE	3178	55.6	3GPP General Partnership Project Standards Body	836	14.6
35	L3 Harris Technologies (form	3142	4940	63.6	IEEE	3142	63.6	Internet Soc/IETF-Internet Eng Task Force	242	4.9
36	University of Minnesota (The	3107	3547	87.6	IEEE	3107	87.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	53	1.5
37	NXP Semiconductors NV	2998	3945	76.0	IEEE	2998	76.0	3GPP General Partnership Project Standards Body	105	2.7
38	Conversant Intellectual Prope	2970	5584	53.2	IEEE	2970	53.2	Primedia Business Magazines & Media Inc.	216	3.9
39	Murata Manufacturing Co. Lt	2920	3806	76.7	IEEE	2920	76.7	IEICE-Inst Elec Info Comm Eng	112	2.9

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40	Motorola Solutions Inc.	2856	4840	59.0	IEEE	2856	59.0	3GPP General Partnership Project Standards Body	358	7.4
41	STMicroelectronics	2814	3807	73.9	IEEE	2814	73.9	RELX Group (Elsevier)	81	2.1
42	Raytheon Co.	2778	4653	59.7	IEEE	2778	59.7	IET/IEE	187	4.0
43	Comcast Corp	2739	10452	26.2	3GPP General Partnership Project Standards B	6202	59.3	IEEE	2739	26.2
44	Toshiba Corp	2569	4878	52.7	IEEE	2569	52.7	International Telecommunication Union	318	6.5
45	Verizon Communications Inc	2535	6934	36.6	IEEE	2535	36.6	Internet Soc/IETF-Internet Eng Task Force	1249	18.0
46	Columbia University	2506	4042	62.0	IEEE	2506	62.0	ACM-Assoc Comput Mach	415	10.3
47	Technicolor SA	2439	4748	51.4	IEEE	2439	51.4	ISO/IEC/JTC/ANSI	263	5.5
48	Industrial Technology Researc	2374	3549	66.9	IEEE	2374	66.9	3GPP General Partnership Project Standards Body	382	10.8
49	CPG TECHNOLOGIES INC	2342	3018	77.6	IEEE	2342	77.6	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	151	5.0
50	Mitsubishi Electric Corp	2291	5490	41.7	IEEE	2291	41.7	3GPP General Partnership Project Standards Body	1281	23.3
51	Honeywell International Inc.	2216	3780	58.6	IEEE	2216	58.6	RELX Group (Elsevier)	159	4.2
52	Corning Inc.	2133	3465	61.6	IEEE	2133	61.6	IET/IEE	318	9.2
53	Analog Devices Inc.	2079	2621	79.3	IEEE	2079	79.3	IET/IEE	74	2.8
54	Silicon Laboratories Inc	2078	2649	78.4	IEEE	2078	78.4	RELX Group (Elsevier)	118	4.5
55	Digimarc Corp.	2077	5089	40.8	IEEE	2077	40.8	SPIE-Int Soc Opt Engineering	578	11.4
56	Semiconductor Energy Labor	1967	16970	11.6	SID-Society for Information Display	5698	33.6	American Institute of Physics	3050	18.0
57	Softbank Corp	1944	6911	28.1	IEEE	1944	28.1	International Telecommunication Union	1855	26.8
58	SIPCO LLC	1935	3177	60.9	IEEE	1935	60.9	ACM-Assoc Comput Mach	246	7.7
59	University of California	1920	3179	60.4	IEEE	1920	60.4	American Institute of Physics	134	4.2
60	Micron Technology Inc.	1890	3022	62.5	IEEE	1890	62.5	IEEE/JPN Soc App Phys	175	5.8
61	TiVo Corp	1850	6603	28.0	IEEE	1850	28.0	ACM-Assoc Comput Mach	512	7.8
62	Xilinx Inc.	1840	4633	39.7	IEEE	1840	39.7	ACM-Assoc Comput Mach	1747	37.7
63	HP Inc	1778	5412	32.9	IEEE	1778	32.9	Internet Soc/IETF-Internet Eng Task Force	704	13.0
64	Pelican Imaging Corporation	1773	3609	49.1	IEEE	1773	49.1	SPIE-Int Soc Opt Engineering	555	15.4
65	Koninklijke Philips N.V.	1710	3518	48.6	IEEE	1710	48.6	3GPP General Partnership Project Standards Body	293	8.3
66	Oracle Corporation	1697	6288	27.0	IEEE	1697	27.0	3GPP General Partnership Project Standards Body	831	13.2
67	HRL Laboratories LLC	1687	2777	60.7	IEEE	1687	60.7	IET/IEE	239	8.6
68	Fraunhofer Gesellschaft	1679	3299	50.9	IEEE	1679	50.9	MPEG.org	265	8.0
69	Hon Hai Precision Industry C	1662	10443	15.9	3GPP General Partnership Project Standards B	5691	54.5	IEEE	1662	15.9
70	Renesas Electronic Corporati	1662	2825	58.8	IEEE	1662	58.8	IEEE/OSA	216	7.6
71	Mediatek Inc.	1594	2831	56.3	IEEE	1594	56.3	3GPP General Partnership Project Standards Body	775	27.4
72	Quarterhill Inc	1576	2336	67.5	IEEE	1576	67.5	3GPP General Partnership Project Standards Body	110	4.7
73	Juniper Networks Inc.	1531	4749	32.2	IEEE	1531	32.2	Network Working Group RFC	1308	27.5
74	Qorvo	1523	1876	81.2	IEEE	1523	81.2	European Microwave Association	82	4.4
75	Infineon Technologies AG	1467	2090	70.2	IEEE	1467	70.2	3GPP General Partnership Project Standards Body	88	4.2
76	SUN PATENT TRUST	1442	5518	26.1	3GPP General Partnership Project Standards B	2251	40.8	IEEE	1442	26.1
77	Dolby Laboratories Inc	1427	4032	35.4	IEEE	1427	35.4	International Telecommunication Union	924	22.9
78	Siemens Aktiengesellschaft	1363	2892	47.1	IEEE	1363	47.1	3GPP General Partnership Project Standards Body	223	7.7
79	California Institute of Techno	1347	2696	50.0	IEEE	1347	50.0	Optical Society of America	200	7.4
80	Microchip Technology Inc.	1316	1964	67.0	IEEE	1316	67.0	International Telecommunication Union	96	4.9

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Tabula Inc	1316	3545	37.1	ACM-Assoc Comput Mach	1337	37.7	IEEE	1316	37.1
82	Hitachi Ltd	1296	3674	35.3	IEEE	1296	35.3	IEICE-Inst Elec Info Comm Eng	307	8.4
83	LibertyMedia	1296	2255	57.5	IEEE	1296	57.5	ACM-Assoc Comput Mach	154	6.8
84	Viasat	1292	1815	71.2	IEEE	1292	71.2	European Microwave Association	69	3.8
85	Canon Inc	1279	3065	41.7	IEEE	1279	41.7	International Telecommunication Union	313	10.2
86	Kandou	1178	1215	97.0	IEEE	1178	97.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	16	1.3
87	ORIGIN WIRELESS INC	1166	1447	80.6	IEEE	1166	80.6	American Institute of Physics	50	3.5
88	Xerox Corp	1148	2740	41.9	IEEE	1148	41.9	ACM-Assoc Comput Mach	743	27.1
89	NUVOTRONICS INC	1137	1344	84.6	IEEE	1137	84.6	IET/IEE	63	4.7
90	Wisteria Trading Inc	1129	2251	50.2	IEEE	1129	50.2	SPIE-Int Soc Opt Engineering	255	11.3
91	Boeing Co. (The)	1127	2252	50.0	IEEE	1127	50.0	SPIE-Int Soc Opt Engineering	84	3.7
92	MONOLITHIC 3D INC	1076	1912	56.3	IEEE	1076	56.3	IEEE/JPN Soc App Phys	206	10.8
93	Lenovo Group Ltd	1067	3725	28.6	3GPP General Partnership Project Standards B	2063	55.4	IEEE	1067	28.6
94	Lockheed Martin Corp.	1047	2751	38.1	IEEE	1047	38.1	Optical Society of America	230	8.4
95	Amazon.com Inc.	1040	3271	31.8	IEEE	1040	31.8	ACM-Assoc Comput Mach	595	18.2
96	United States Navy	1028	1918	53.6	IEEE	1028	53.6	American Physical Society	116	6.0
97	BT Group PLC	1015	2062	49.2	IEEE	1015	49.2	Internet Soc/IETF-Internet Eng Task Force	180	8.7
98	General Electric Company	995	2173	45.8	IEEE	995	45.8	International Telecommunication Union	307	14.1
99	Dell Technologies Inc	975	5535	17.6	ACM-Assoc Comput Mach	2590	46.8	IEEE	975	17.6
100	CenturyLink Inc	969	2358	41.1	IEEE	969	41.1	Internet Soc/IETF-Internet Eng Task Force	274	11.6

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Virtual/Augmented Reality</i>										
1	Microsoft Corporation	2891	6690	43.2	IEEE	2891	43.2	ACM-Assoc Comput Mach	1644	24.6
2	Immersion Corp.	1546	4085	37.8	IEEE	1546	37.8	ACM-Assoc Comput Mach	498	12.2
3	Apple Inc	727	1741	41.8	IEEE	727	41.8	ACM-Assoc Comput Mach	339	19.5
4	Google Inc.	497	1300	38.2	IEEE	497	38.2	ACM-Assoc Comput Mach	386	29.7
5	Sony Corp	370	844	43.8	IEEE	370	43.8	ACM-Assoc Comput Mach	160	19.0
6	Qualcomm Inc	289	616	46.9	IEEE	289	46.9	ACM-Assoc Comput Mach	107	17.4
7	Magic Leap Inc	255	625	40.8	IEEE	255	40.8	Optical Society of America	45	7.2
8	3D Systems Corp.	191	423	45.2	IEEE	191	45.2	ACM-Assoc Comput Mach	109	25.8
9	Osterhout Design Group	189	561	33.7	IEEE	189	33.7	ACM-Assoc Comput Mach	175	31.2
10	Lincoln Electric Holdings Inc	161	440	36.6	ACM-Assoc Comput Mach	206	46.8	IEEE	161	36.6
11	Massachusetts Institute of Te	158	320	49.4	IEEE	158	49.4	ACM-Assoc Comput Mach	60	18.8
12	University of North Carolina	156	354	44.1	IEEE	156	44.1	ACM-Assoc Comput Mach	118	33.3
13	Intellectual Ventures Manage	149	348	42.8	IEEE	149	42.8	ACM-Assoc Comput Mach	111	31.9
14	International Business Machi	146	469	31.1	IEEE	146	31.1	ACM-Assoc Comput Mach	101	21.5
15	AT&T Inc	125	290	43.1	IEEE	125	43.1	ACM-Assoc Comput Mach	75	25.9
16	BRAINGATE CO LLC	120	308	39.0	IEEE	120	39.0	RELX Group (Elsevier)	45	14.6
17	Intel Corporation	116	229	50.7	IEEE	116	50.7	ACM-Assoc Comput Mach	57	24.9
18	Ultrahaptics ltd.	115	263	43.7	IEEE	115	43.7	ACM-Assoc Comput Mach	54	20.5
19	Xperi Corporation (Formerly	115	199	57.8	IEEE	115	57.8	ACM-Assoc Comput Mach	25	12.6
20	P4TENTS1 LLC	112	182	61.5	IEEE	112	61.5	ACM-Assoc Comput Mach	21	11.5
21	Facebook Inc	106	267	39.7	IEEE	106	39.7	ACM-Assoc Comput Mach	61	22.8
22	Medtronic Inc	100	148	67.6	IEEE	100	67.6	Lippincott Williams & Wilkins Ltd.	6	4.1
23	Nokia Corp	99	201	49.3	IEEE	99	49.3	ACM-Assoc Comput Mach	36	17.9
24	Digimarc Corp.	97	193	50.3	IEEE	97	50.3	ACM-Assoc Comput Mach	33	17.1
25	Samsung Electronics Co Ltd	93	223	41.7	IEEE	93	41.7	ACM-Assoc Comput Mach	51	22.9
26	ConvergeOne Inc	84	192	43.8	IEEE	84	43.8	ACM-Assoc Comput Mach	22	11.5
27	TANGIS CORP	83	526	15.8	Joint IEEE and ACM	281	53.4	ACM-Assoc Comput Mach	94	17.9
28	Walt Disney Co.	83	221	37.6	IEEE	83	37.6	ACM-Assoc Comput Mach	68	30.8
29	North Inc. (formerly Thalmic	78	168	46.4	IEEE	78	46.4	ACM-Assoc Comput Mach	39	23.2
30	University of Arizona	68	307	22.1	Optical Society of America	76	24.8	IEEE	68	22.1
31	HRL Laboratories LLC	67	145	46.2	IEEE	67	46.2	ACM-Assoc Comput Mach	17	11.7
32	Tobii Ab	62	113	54.9	IEEE	62	54.9	ACM-Assoc Comput Mach	32	28.3
33	Canon Inc	59	198	29.8	IEEE	59	29.8	ACM-Assoc Comput Mach	40	20.2
34	Honda Motor Co. Ltd.	59	98	60.2	IEEE	59	60.2	RELX Group (Elsevier)	9	9.2
35	Amazon.com Inc.	55	190	28.9	ACM-Assoc Comput Mach	83	43.7	IEEE	55	28.9
36	ELECTRONIC SCRIPTING	55	105	52.4	IEEE	55	52.4	Joint IEEE and ACM	24	22.9
37	Ostendo Technologies Inc	55	156	35.3	IEEE	55	35.3	ACM-Assoc Comput Mach	35	22.4
38	California Institute of Techno	54	141	38.3	IEEE	54	38.3	American Physiological Society	18	12.8
39	APPLIED RESEARCH ASS	52	89	58.4	IEEE	52	58.4	MIT/MIT Press	9	10.1

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	BUTTERFLY NETWORKS I	52	60	86.7	IEEE	52	86.7	Acoustical Society of America	4	6.7
41	Stanford University	50	89	56.2	IEEE	50	56.2	ACM-Assoc Comput Mach	8	9.0
42	ONPOINT MEDICAL INC	49	121	40.5	IEEE	49	40.5	RELX Group (Elsevier)	15	12.4
43	Siemens Aktiengesellschaft	47	116	40.5	IEEE	47	40.5	Joint IEEE and ACM	29	25.0
44	Lockheed Martin Corp.	46	229	20.1	IEEE	46	20.1	SPIE-Int Soc Opt Engineering	27	11.8
45	Oracle Corporation	46	105	43.8	IEEE	46	43.8	ACM-Assoc Comput Mach	37	35.2
46	Technicolor SA	46	63	73.0	IEEE	46	73.0	ACM-Assoc Comput Mach	5	7.9
47	Autodesk Inc.	45	293	15.4	ACM-Assoc Comput Mach	191	65.2	IEEE	45	15.4
48	ORCAM TECHNOLOGIES	43	52	82.7	IEEE	43	82.7	Springer/Sp. Wien/Springer-Verlag/KluwAcad	4	7.7
49	Johnson & Johnson	42	133	31.6	IEEE	42	31.6	RELX Group (Elsevier)	38	28.6
50	The Invention Science Fund I	42	87	48.3	IEEE	42	48.3	RELX Group (Elsevier)	14	16.1
51	Nant Holdings IP Llc	40	60	66.7	IEEE	40	66.7	International Association for Pattern Recognition (IAPR)	5	8.3
52	Ohio State University	40	60	66.7	IEEE	40	66.7	RELX Group (Elsevier)	6	10.0
53	Elwha LLC	39	80	48.8	IEEE	39	48.8	Joint IEEE and ACM	14	17.5
54	HP Inc	38	92	41.3	IEEE	38	41.3	ACM-Assoc Comput Mach	26	28.3
55	Surefire LLC	38	49	77.6	IEEE	38	77.6	IEEE/OSA	11	22.4
56	GoPro Inc	37	58	63.8	IEEE	37	63.8	ACM-Assoc Comput Mach	7	12.1
57	Nintendo Co. Ltd.	36	232	15.5	Nintendo of America	130	56.0	IEEE	36	15.5
58	Toshiba Corp	36	51	70.6	IEEE	36	70.6	ACM-Assoc Comput Mach	5	9.8
59	Cisco Systems Inc.	35	79	44.3	IEEE	35	44.3	Internet Soc/IETF-Internet Eng Task Force	10	12.7
60	Intuitive Surgical Inc.	33	44	75.0	IEEE	33	75.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	2	4.5
61	Toyota Motor Corp	32	85	37.6	IEEE	32	37.6	ACM-Assoc Comput Mach	30	35.3
62	L3 Harris Technologies (form	31	58	53.4	IEEE	31	53.4	MIT/MIT Press	6	10.3
63	Panasonic Corporation	31	59	52.5	IEEE	31	52.5	RELX Group (Elsevier)	5	8.5
64	Fujitsu Limited	30	67	44.8	IEEE	30	44.8	ACM-Assoc Comput Mach	11	16.4
65	North Carolina State Universi	30	35	85.7	IEEE	30	85.7	Joint IEEE and ACM	2	5.7
66	Pelican Imaging Corporation	30	37	81.1	IEEE	30	81.1	ACM-Assoc Comput Mach	5	13.5
67	Rag Foundation	30	41	73.2	IEEE	30	73.2	RELX Group (Elsevier)	6	14.6
68	BERTEC CORP	29	40	72.5	IEEE	29	72.5	American Association of Physics Teachers	4	10.0
69	Drexel University	28	31	90.3	IEEE	28	90.3	International Association for Pattern Recognition (IAPR)	1	3.2
70	Uber Technologies Inc	28	46	60.9	IEEE	28	60.9	Joint IET and IEEE	11	23.9
71	University of South Florida	28	56	50.0	IEEE	28	50.0	RELX Group (Elsevier)	10	17.9
72	Boeing Co. (The)	27	62	43.5	IEEE	27	43.5	ACM-Assoc Comput Mach	10	16.1
73	Ford Motor Co.	26	64	40.6	IEEE	26	40.6	ACM-Assoc Comput Mach	19	29.7
74	Acuity Brands Inc.	25	29	86.2	IEEE	25	86.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	10.3
75	Adidas AG	25	82	30.5	IEEE	25	30.5	RELX Group (Elsevier)	12	14.6
76	HELP LIGHTING INC	25	156	16.0	ACM-Assoc Comput Mach	101	64.7	IEEE	25	16.0
77	LEGEND3D INC	25	28	89.3	IEEE	25	89.3	International Association for Pattern Recognition (IAPR)	3	10.7
78	State University of New York	25	47	53.2	IEEE	25	53.2	ACM-Assoc Comput Mach	18	38.3
79	University of Maryland	25	25	100.0	IEEE	25	100.0			
80	University of Washington	25	54	46.3	IEEE	25	46.3	ACM-Assoc Comput Mach	10	18.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	ZSPACE INC	25	104	24.0	IEEE	25	24.0	ACM-Assoc Comput Mach	21	20.2
82	GlowPoint Inc.	24	36	66.7	IEEE	24	66.7	ACM-Assoc Comput Mach	12	33.3
83	Honeywell International Inc.	24	61	39.3	IEEE	24	39.3	RELX Group (Elsevier)	5	8.2
84	INDIVIDUAL PATENTER	24	56	42.9	IEEE	24	42.9	ACM-Assoc Comput Mach	6	10.7
85	Johns Hopkins University	24	41	58.5	IEEE	24	58.5	Joint IEEE and ACM	4	9.8
86	ULTIMATEPOINTER LLC	24	49	49.0	IEEE	24	49.0	ACM-Assoc Comput Mach	17	34.7
87	University of Connecticut	24	134	17.9	Optical Society of America	38	28.4	IEEE	24	17.9
88	AUGMENTED VISION INC	23	44	52.3	IEEE	23	52.3	ACM-Assoc Comput Mach	13	29.5
89	Comcast Corp	23	54	42.6	IEEE	23	42.6	SPIE-Int Soc Opt Engineering	17	31.5
90	Harvard University	23	53	43.4	IEEE	23	43.4	American Institute of Physics	7	13.2
91	UNIVERSIDADE DE COIM	23	39	59.0	IEEE	23	59.0	INRIA Grenoble - Rhône-Alpes	2	5.1
92	Koninklijke Philips N.V.	22	67	32.8	IEEE	22	32.8	ACM-Assoc Comput Mach	8	11.9
93	Cedar Ridge Research LLC	21	34	61.8	IEEE	21	61.8	American Institute of Physics	8	23.5
94	Queen's Univerity of Kingsto	20	135	14.8	ACM-Assoc Comput Mach	87	64.4	IEEE	20	14.8
95	NVIDIA Corp.	19	113	16.8	ACM-Assoc Comput Mach	41	36.3	IEEE	19	16.8
96	Agency for Science Technolo	18	34	52.9	IEEE	18	52.9	RELX Group (Elsevier)	8	23.5
97	COMPUTERIZED MEDICA	18	50	36.0	IEEE	18	36.0	RELX Group (Elsevier)	9	18.0
98	Huawei Technologies Compa	18	34	52.9	IEEE	18	52.9	ACM-Assoc Comput Mach	7	20.6
99	Nio Co. Ltd	18	27	66.7	IEEE	18	66.7	ACM-Assoc Comput Mach	7	25.9
100	Seiko Epson Corporation	18	77	23.4	Joint IEEE and ACM	50	64.9	IEEE	18	23.4

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<i>Wind Energy</i>										
1	Vestas Wind Systems A/S	428	913	46.9	IEEE	428	46.9	AWEA-American Wind Energy Association	98	10.7
2	General Electric Company	184	507	36.3	IEEE	184	36.3	US Dept of Energy	114	22.5
3	ABB Ltd	145	247	58.7	IEEE	145	58.7	EWEA-European Wind Energy Association	18	7.3
4	Siemens Aktiengesellschaft	73	118	61.9	IEEE	73	61.9	RELX Group (Elsevier)	11	9.3
5	SolarEdge Technologies Inc	61	76	80.3	IEEE	61	80.3	WIP-Renewable Energies	7	9.2
6	Arizona State University	49	55	89.1	IEEE	49	89.1	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	3	5.5
7	Ingeteam Corporation SA	46	73	63.0	IEEE	46	63.0	EWEA-European Wind Energy Association	6	8.2
8	Enercon GmbH	37	42	88.1	IEEE	37	88.1	RELX Group (Elsevier)	2	4.8
9	University of Nebraska	37	38	97.4	IEEE	37	97.4	Institution of Engineering and Technology	1	2.6
10	University of Alabama	30	37	81.1	IEEE	30	81.1	IET/IEE	6	16.2
11	Rensselaer Polytechnic Instit	25	27	92.6	IEEE	25	92.6	American Institute of Physics	1	3.7
12	University of New Brunswick	25	27	92.6	IEEE	25	92.6	AIAA-Am Inst Aero Astro	1	3.7
13	Tigo Energy Inc	22	26	84.6	IEEE	22	84.6	WIP-Renewable Energies	3	11.5
14	National Cheng Kung Univer	18	19	94.7	IEEE	18	94.7	IET/IEE	1	5.3
15	UWM Research Foundation	17	19	89.5	IEEE	17	89.5	RELX Group (Elsevier)	1	5.3
16	Senvion SE	15	50	30.0	IEEE	15	30.0	AIAA-Am Inst Aero Astro	10	20.0
17	INDIVIDUAL PATENTER	13	31	41.9	IEEE	13	41.9	ASME-Am Soc Mech Eng	7	22.6
18	TechnipFMC	13	17	76.5	IEEE	13	76.5	Mcgraw Hill	1	5.9
19	Fujitsu Limited	12	13	92.3	IEEE	12	92.3	RELX Group (Elsevier)	1	7.7
20	Nordex SE	12	20	60.0	IEEE	12	60.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4	20.0
21	NRG SYSTEMS INC	12	22	54.5	IEEE	12	54.5	RELX Group (Elsevier)	4	18.2
22	UNIVERSITY OF ZAGREB	12	14	85.7	IEEE	12	85.7	China Electrochemical Society	1	7.1
23	SPARQ SYSTEMS INC	11	14	78.6	IEEE	11	78.6	IET/IEE	2	14.3
24	Woodward Inc	10	10	100.0	IEEE	10	100.0			
25	Kite Gen Research Srl	9	21	42.9	IEEE	9	42.9	RELX Group (Elsevier)	7	33.3
26	ZOND ENERGY SYSTEMS	9	11	81.8	IEEE	9	81.8	RELX Group (Elsevier)	1	9.1
27	US WIND TECHNOLOGY L	8	8	100.0	IEEE	8	100.0			
28	GENEDICS CLEAN ENERG	7	63	11.1	RELX Group (Elsevier)	49	77.8	AAAS-Am Assoc Advancement Sci	7	11.1
29	GENEDICS LLC	6	47	12.8	RELX Group (Elsevier)	35	74.5	AAAS-Am Assoc Advancement Sci	6	12.8
30	Hitachi Ltd	6	9	66.7	IEEE	6	66.7	Hitachi Ltd.	3	33.3
31	Medtronic Inc	6	7	85.7	IEEE	6	85.7	MacMillan Publishing Company	1	14.3
32	GREEN ENERGY CORP	5	5	100.0	IEEE	5	100.0			
33	LSIS Co Ltd (Formerly LS In	5	7	71.4	IEEE	5	71.4	IET/IEE	1	14.3
34	Mitsubishi Heavy Industries	5	54	9.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	27	50.0	ASME-Am Soc Mech Eng	13	24.1
35	NEC Corp	5	6	83.3	IEEE	5	83.3	Institute of Electrical Engineers of Japan	1	16.7
36	PRENAV INC	5	5	100.0	IEEE	5	100.0			
37	RHEINISCH-WESTFALISC	5	5	100.0	IEEE	5	100.0			
38	University of Western Ontari	5	5	100.0	IEEE	5	100.0			
39	Alstom	4	6	66.7	IEEE	4	66.7	A B B Corporate Management Services AG	2	33.3

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Honeywell International Inc.	4	6	66.7	IEEE	4	66.7	TIMES MIRROR MAG INC	1	16.7
41	HYPER TECH RESEARCH	4	4	100.0	IEEE	4	100.0			
42	KK WIND SOLUTIONS A/S	4	4	100.0	IEEE	4	100.0			
43	NORTHERN POWER SYST	4	5	80.0	IEEE	4	80.0	PennWell Publishing Co.	1	20.0
44	UNIVERSIDAD PUBLICA	4	5	80.0	IEEE	4	80.0	Instrument Society of America	1	20.0
45	X Development Llc	4	10	40.0	IEEE	4	40.0	AIAA-Am Inst Aero Astro	3	30.0
46	AB SKF	3	3	100.0	IEEE	3	100.0			
47	COMBINED ENERGIES LL	3	3	100.0	IEEE	3	100.0			
48	Corteva Agriscience(former	3	24	12.5	RELX Group (Elsevier)	7	29.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	12.5
49	Daewoo Shipbuilding & Mari	3	6	50.0	IEEE	3	50.0	MacMillan Publishing Company	1	16.7
50	EMPIRE MAGNETICS INC	3	3	100.0	IEEE	3	100.0			
51	GLOBAL ENERGYCONCE	3	5	60.0	IEEE	3	60.0	PCIM (Power Conversion, Intelligent Motion)	1	20.0
52	Korea Electric Power Corp	3	7	42.9	IEEE	3	42.9	RELX Group (Elsevier)	3	42.9
53	Nanyang Technological Univ	3	3	100.0	IEEE	3	100.0			
54	SAMAYS INNOVACIONES	3	5	60.0	IEEE	3	60.0	BIRKHAUSER VERLAG AG, VIADUKSTRASSE 40-44, PO	1	20.0
55	Schweitzer Engineering Labo	3	3	100.0	IEEE	3	100.0			
56	University of Florida	3	39	7.7	American Institute of Physics	12	30.8	ACS-Am Chem Soc	6	15.4
57	University of Wisconsin	3	3	100.0	IEEE	3	100.0			
58	ADVANCED MAGNET LA	2	2	100.0	IEEE	2	100.0			
59	Alliance for Sustainable Ener	2	12	16.7	ASME-Am Soc Mech Eng	7	58.3	IEEE	2	16.7
60	Apple Inc	2	2	100.0	IEEE	2	100.0			
61	Bosch (Robert) GmbH	2	2	100.0	IEEE	2	100.0			
62	Consiglio Nazionale Delle Ri	2	2	100.0	IEEE	2	100.0			
63	Dana Holding Corp.	2	3	66.7	IEEE	2	66.7	EVS.org	1	33.3
64	HAWAIIAN ELECTRIC CO	2	4	50.0	IEEE	2	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0
65	IDENTIFLIGHT INTERNAT	2	3	66.7	IEEE	2	66.7	Massachusetts Institute of Technology	1	33.3
66	International Business Machi	2	9	22.2	RELX Group (Elsevier)	6	66.7	IEEE	2	22.2
67	Intertrust Technologies Corp	2	2	100.0	IEEE	2	100.0			
68	L3 Harris Technologies (form	2	4	50.0	IEEE	2	50.0	RELX Group (Elsevier)	2	50.0
69	ONSEMBLE LLC	2	4	50.0	IEEE	2	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0
70	Rockwell Automation Inc	2	2	100.0	IEEE	2	100.0			
71	ROCKY RESEARCH	2	4	50.0	IEEE	2	50.0	Electric Power Research Institute	1	25.0
72	Rolls Royce Holdings Plc	2	7	28.6	ASME-Am Soc Mech Eng	4	57.1	IEEE	2	28.6
73	Trevii - Finanziaria Industrial	2	2	100.0	IEEE	2	100.0			
74	Airbus SE	1	4	25.0	RELX Group (Elsevier)	1	25.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1	25.0
75	American Superconductor Co	1	1	100.0	IEEE	1	100.0			
76	BASELOAD ENERGY INC	1	2	50.0	Konggansa	1	50.0	IEEE	1	50.0
77	BEIJING GOLDWIND SCIE	1	1	100.0	IEEE	1	100.0			
78	BLUE WATER SHIPPING A	1	1	100.0	IEEE	1	100.0			
79	BOARD OF TRUSTEES OF	1	1	100.0	IEEE	1	100.0			
80	California Institute of Techno	1	6	16.7	RELX Group (Elsevier)	4	66.7	IEEE	1	16.7

Appendix B: Top 100 Organizations That Cite IEEE; (1999-2019 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Cisco Systems Inc.	1	1	100.0	IEEE	1	100.0			
82	CLEAN CURRENT LP	1	3	33.3	AIAA-Am Inst Aero Astro	1	33.3	PROFESSIONAL ENGINEERING PUBLISHING LTD	1	33.3
83	DOMETIC SWEDEN AB	1	1	100.0	IEEE	1	100.0			
84	Fiat Chrysler Automobiles N	1	1	100.0	IEEE	1	100.0			
85	Florida State University	1	1	100.0	IEEE	1	100.0			
86	General Motors Corp	1	4	25.0	China Electrochemical Society	2	50.0	American Automatic Control Council (AACC)	1	25.0
87	GLOUSTER APPLICATION	1	8	12.5	RELX Group (Elsevier)	6	75.0	IEEE	1	12.5
88	Indiana University	1	5	20.0	RELX Group (Elsevier)	2	40.0	SAE-Society of Automobile Engineers	1	20.0
89	Institut Francais du Petrole	1	3	33.3	American Automatic Control Council (AACC)	2	66.7	IEEE	1	33.3
90	INVENTUS HOLDINGS LL	1	2	50.0	IEEE	1	50.0	American Automatic Control Council (AACC)	1	50.0
91	JST LLC	1	2	50.0	IEEE	1	50.0	Konggansa	1	50.0
92	Khalifa University of Science	1	1	100.0	IEEE	1	100.0			
93	KITENERGY S R L	1	2	50.0	IEEE	1	50.0	American Automatic Control Council (AACC)	1	50.0
94	MAGNOMATICS LTD	1	2	50.0	IEEE	1	50.0	IET/IEE	1	50.0
95	MAKANI POWER INC	1	1	100.0	IEEE	1	100.0			
96	Mitsuba Corp.	1	1	100.0	IEEE	1	100.0			
97	Mitsubishi Electric Corp	1	1	100.0	IEEE	1	100.0			
98	Naval Group	1	1	100.0	IEEE	1	100.0			
99	Ogin Inc (Formerly FloDesig	1	20	5.0	AIAA-Am Inst Aero Astro	11	55.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	40.0
100	OXFORD BROOKES UNIV	1	3	33.3	RELX Group (Elsevier)	2	66.7	IEEE	1	33.3

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
1	Microsoft Corporation	62741	182895	34.3	IEEE	62741	34.3	ACM-Assoc Comput Mach	51798	28.3
2	International Business Machin	57947	171342	33.8	IEEE	57947	33.8	ACM-Assoc Comput Mach	31459	18.4
3	Micron Technology Inc.	44408	131329	33.8	IEEE	44408	33.8	RELX Group (Elsevier)	21295	16.2
4	Qualcomm Inc	38637	92134	41.9	IEEE	38637	41.9	3GPP General Partnership Project Standards Body	17830	19.4
5	Apple Inc	36754	87946	41.8	IEEE	36754	41.8	ACM-Assoc Comput Mach	19716	22.4
6	Intel Corporation	32096	67828	47.3	IEEE	32096	47.3	3GPP General Partnership Project Standards Body	7462	11.0
7	AT&T Inc	31309	56552	55.4	IEEE	31309	55.4	ACM-Assoc Comput Mach	4019	7.1
8	Broadcom Ltd	30298	50324	60.2	IEEE	30298	60.2	ACM-Assoc Comput Mach	1662	3.3
9	Marvell Technology Group Lt	23807	29909	79.6	IEEE	23807	79.6	3GPP General Partnership Project Standards Body	3111	10.4
10	Google Inc.	19658	55396	35.5	IEEE	19658	35.5	ACM-Assoc Comput Mach	12474	22.5
11	Nokia Corp	18946	51380	36.9	IEEE	18946	36.9	3GPP General Partnership Project Standards Body	10072	19.6
12	Semiconductor Energy Labora	17413	173831	10.0	SID-Society for Information Display	52439	30.2	American Institute of Physics	33318	19.2
13	Samsung Electronics Co Ltd	15055	49660	30.3	IEEE	15055	30.3	3GPP General Partnership Project Standards Body	11807	23.8
14	Cisco Systems Inc.	14188	44678	31.8	IEEE	14188	31.8	Internet Soc/IETF-Internet Eng Task Force	7044	15.8
15	Ericsson	13790	46312	29.8	3GPP General Partnership Project Standards Bo	17724	38.3	IEEE	13790	29.8
16	Massachusetts Institute of Tec	12982	48614	26.7	IEEE	12982	26.7	RELX Group (Elsevier)	5871	12.1
17	Siemens Aktiengesellschaft	12471	30407	41.0	IEEE	12471	41.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2500	8.2
18	Sony Corp	12304	29293	42.0	IEEE	12304	42.0	ACM-Assoc Comput Mach	2413	8.2
19	InterDigital Inc	12114	50266	24.1	3GPP General Partnership Project Standards Bo	32473	64.6	IEEE	12114	24.1
20	Oracle Corporation	12002	43832	27.4	ACM-Assoc Comput Mach	13551	30.9	IEEE	12002	27.4
21	MONOLITHIC 3D INC	11683	20071	58.2	IEEE	11683	58.2	IEEE/JPN Soc App Phys	2208	11.0
22	Western Digital Corp.	11572	22630	51.1	IEEE	11572	51.1	American Institute of Physics	2294	10.1
23	Texas Instruments Inc	11489	18026	63.7	IEEE	11489	63.7	American Institute of Physics	655	3.6
24	ParkerVision Inc	11447	22579	50.7	IEEE	11447	50.7	IET/IEE	5335	23.6
25	Medtronic Inc	11281	133222	8.5	RELX Group (Elsevier)	23076	17.3	Lippincott Williams & Wilkins Ltd.	16239	12.2
26	Panasonic Corporation	10066	30810	32.7	IEEE	10066	32.7	3GPP General Partnership Project Standards Body	4982	16.2
27	Xperi Corporation (Formerly	9833	17738	55.4	IEEE	9833	55.4	ACM-Assoc Comput Mach	1103	6.2
28	Huawei Technologies Compan	9408	34241	27.5	3GPP General Partnership Project Standards Bo	13940	40.7	IEEE	9408	27.5
29	Taiwan Semiconductor Manuf	9209	25301	36.4	IEEE	9209	36.4	American Institute of Physics	7213	28.5
30	Personalized Media Communi	9127	55057	16.6	Society of Motion Picture and Television Engin	16618	30.2	IEEE	9127	16.6
31	LG Electronics Inc.	8858	42985	20.6	3GPP General Partnership Project Standards Bo	23757	55.3	IEEE	8858	20.6
32	Toshiba Corp	8731	21101	41.4	IEEE	8731	41.4	American Institute of Physics	1603	7.6
33	Fujitsu Limited	8550	23671	36.1	IEEE	8550	36.1	3GPP General Partnership Project Standards Body	2888	12.2
34	HP Inc	8098	26267	30.8	IEEE	8098	30.8	ACM-Assoc Comput Mach	3924	14.9
35	NXP Semiconductors NV	8043	13021	61.8	IEEE	8043	61.8	American Institute of Physics	915	7.0
36	Rambus Inc.	7848	11719	67.0	IEEE	7848	67.0	IEEE/JPN Soc App Phys	556	4.7
37	STMicroelectronics	7684	12679	60.6	IEEE	7684	60.6	RELX Group (Elsevier)	898	7.1
38	NEC Corp	7642	22831	33.5	IEEE	7642	33.5	3GPP General Partnership Project Standards Body	5065	22.2
39	General Electric Company	7567	28606	26.5	IEEE	7567	26.5	US Dept of Energy	3167	11.1
40	Koninklijke Philips N.V.	7448	27506	27.1	IEEE	7448	27.1	RELX Group (Elsevier)	2850	10.4

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
41	Honeywell International Inc.	7405	18276	40.5	IEEE	7405	40.5	RELX Group (Elsevier)	1857	10.2
42	Macronix International Co. Lt	7257	13387	54.2	IEEE	7257	54.2	IEEE/JPN Soc App Phys	2514	18.8
43	Partners HealthCare Systems I	6849	91550	7.5	Optical Society of America	28995	31.7	RELX Group (Elsevier)	13130	14.3
44	Blackberry Ltd.	6714	24000	28.0	3GPP General Partnership Project Standards Bo	9136	38.1	IEEE	6714	28.0
45	University of California	6494	51524	12.6	RELX Group (Elsevier)	7077	13.7	IEEE	6494	12.6
46	Irobot Corp	6304	10953	57.6	IEEE	6304	57.6	SPIE-Int Soc Opt Engineering	1520	13.9
47	Tela Innovations inc	6293	19414	32.4	SPIE-Int Soc Opt Engineering	6481	33.4	IEEE	6293	32.4
48	Infineon Technologies AG	6093	10651	57.2	IEEE	6093	57.2	American Institute of Physics	903	8.5
49	Conversant Intellectual Propert	6073	9656	62.9	IEEE	6073	62.9	IEEE/JPN Soc App Phys	257	2.7
50	Cadence Design Systems Inc	5944	13637	43.6	IEEE	5944	43.6	Joint IEEE and ACM	4327	31.7
51	REARDEN LLC	5943	6649	89.4	IEEE	5943	89.4	IET/IEE	197	3.0
52	Xerox Corp	5819	20444	28.5	IEEE	5819	28.5	ACM-Assoc Comput Mach	3562	17.4
53	Boston Scientific Corp.	5811	77016	7.5	RELX Group (Elsevier)	20830	27.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	9295	12.1
54	Columbia University	5767	19165	30.1	IEEE	5767	30.1	ACM-Assoc Comput Mach	1841	9.6
55	Intuitive Surgical Inc.	5754	11041	52.1	IEEE	5754	52.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	572	5.2
56	Canon Inc	5752	20754	27.7	IEEE	5752	27.7	RELX Group (Elsevier)	1918	9.2
57	Qorvo	5744	6837	84.0	IEEE	5744	84.0	American Institute of Physics	363	5.3
58	Murata Manufacturing Co. Lt	5718	7656	74.7	IEEE	5718	74.7	RELX Group (Elsevier)	215	2.8
59	Motorola Solutions Inc.	5486	11209	48.9	IEEE	5486	48.9	American Institute of Physics	1016	9.1
60	Xilinx Inc.	5475	14890	36.8	ACM-Assoc Comput Mach	5632	37.8	IEEE	5475	36.8
61	California Institute of Technol	5462	29730	18.4	IEEE	5462	18.4	RELX Group (Elsevier)	4301	14.5
62	Commscope Inc.	5458	9454	57.7	IEEE	5458	57.7	3GPP General Partnership Project Standards Body	484	5.1
63	Synopsys Inc.	5429	15580	34.8	IEEE	5429	34.8	SPIE-Int Soc Opt Engineering	3169	20.3
64	Mitsubishi Electric Corp	5421	12061	44.9	IEEE	5421	44.9	3GPP General Partnership Project Standards Body	1306	10.8
65	CPG TECHNOLOGIES INC	5393	6921	77.9	IEEE	5393	77.9	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AVE	351	5.1
66	Fractus SA	5362	8963	59.8	IEEE	5362	59.8	IET/IEE	1307	14.6
67	Ricoh Co. Ltd.	5285	12067	43.8	IEEE	5285	43.8	ACM-Assoc Comput Mach	1825	15.1
68	ZENO SEMICONDUCTOR I	5130	6684	76.8	IEEE	5130	76.8	IEEE/JPN Soc App Phys	1221	18.3
69	Nippon Telegraph & Telephon	5096	16192	31.5	IEEE	5096	31.5	3GPP General Partnership Project Standards Body	4581	28.3
70	Hitachi Ltd	5085	18326	27.7	IEEE	5085	27.7	ACM-Assoc Comput Mach	1379	7.5
71	HRL Laboratories LLC	5070	10049	50.5	IEEE	5070	50.5	American Institute of Physics	634	6.3
72	Raytheon Co.	5015	10728	46.7	IEEE	5015	46.7	SPIE-Int Soc Opt Engineering	623	5.8
73	Renesas Electronic Corporatio	4902	8158	60.1	IEEE	4902	60.1	IEEE/JPN Soc App Phys	496	6.1
74	RPX Corp	4887	11829	41.3	IEEE	4887	41.3	Internet Soc/IETF-Internet Eng Task Force	913	7.7
75	Adobe Inc. (former Adobe Syst	4857	12387	39.2	IEEE	4857	39.2	ACM-Assoc Comput Mach	4120	33.3
76	Cypress Semiconductor Corp.	4793	7029	68.2	IEEE	4793	68.2	Joint IEEE and ACM	472	6.7
77	Verizon Communications Inc	4775	17761	26.9	IEEE	4775	26.9	ACM-Assoc Comput Mach	3062	17.2
78	Abbott Laboratories	4751	103290	4.6	RELX Group (Elsevier)	24527	23.7	ACS-Am Chem Soc	12527	12.1
79	Industrial Technology Research	4737	9226	51.3	IEEE	4737	51.3	RELX Group (Elsevier)	857	9.3
80	Immersion Corp.	4729	12510	37.8	IEEE	4729	37.8	ACM-Assoc Comput Mach	1505	12.0

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	University of Illinois	4716	37852	12.5	American Institute of Physics	7735	20.4	ACS-Am Chem Soc	5032	13.3
82	Electronics and Telecommunic	4687	9521	49.2	IEEE	4687	49.2	3GPP General Partnership Project Standards Body	878	9.2
83	Advanced Micro Devices Inc	4680	10494	44.6	IEEE	4680	44.6	Joint IEEE and ACM	961	9.2
84	University of Minnesota (The	4635	9882	46.9	IEEE	4635	46.9	RELX Group (Elsevier)	989	10.0
85	Adaptix	4607	6706	68.7	IEEE	4607	68.7	European Telecom Standards Institute (ETSI)	730	10.9
86	SolarEdge Technologies Inc	4526	5209	86.9	IEEE	4526	86.9	WIP-Renewable Energies	324	6.2
87	Digimarc Corp.	4481	11048	40.6	IEEE	4481	40.6	SPIE-Int Soc Opt Engineering	1336	12.1
88	Applied Materials Inc.	4432	17988	24.6	IEEE	4432	24.6	American Institute of Physics	3510	19.5
89	Dexcom Inc	4430	66601	6.7	RELX Group (Elsevier)	16871	25.3	American Diabetes Association	6945	10.4
90	Hon Hai Precision Industry Co	4344	22599	19.2	3GPP General Partnership Project Standards Bo	5763	25.5	IEEE	4344	19.2
91	Cree Inc.	4326	11583	37.3	IEEE	4326	37.3	American Institute of Physics	2587	22.3
92	Dolby Laboratories Inc	4242	9243	45.9	IEEE	4242	45.9	International Telecommunication Union	1006	10.9
93	Thermo Fisher Scientific Inc	4220	27442	15.4	RELX Group (Elsevier)	7751	28.2	IEEE	4220	15.4
94	L3 Harris Technologies (forme	4191	7115	58.9	IEEE	4191	58.9	RELX Group (Elsevier)	353	5.0
95	Witricity Corp	4156	6677	62.2	IEEE	4156	62.2	American Institute of Physics	576	8.6
96	Technicolor SA	4065	7876	51.6	IEEE	4065	51.6	ACM-Assoc Comput Mach	391	5.0
97	Amazon.com Inc.	4025	14380	28.0	IEEE	4025	28.0	ACM-Assoc Comput Mach	3855	26.8
98	Analog Devices Inc.	3960	5961	66.4	IEEE	3960	66.4	RELX Group (Elsevier)	566	9.5
99	Dell Technologies Inc	3872	15371	25.2	ACM-Assoc Comput Mach	5738	37.3	IEEE	3872	25.2
100	Softbank Corp	3710	10804	34.3	IEEE	3710	34.3	International Telecommunication Union	1882	17.4
101	Fraunhofer Gesellschaft	3691	7808	47.3	IEEE	3691	47.3	RELX Group (Elsevier)	504	6.5
102	On Semiconductor Corporatio	3653	5010	72.9	IEEE	3653	72.9	RELX Group (Elsevier)	309	6.2
103	Commvault Systems Inc.	3613	5467	66.1	IEEE	3613	66.1	ACM-Assoc Comput Mach	886	16.2
104	Lockheed Martin Corp.	3602	18342	19.6	IEEE	3602	19.6	RELX Group (Elsevier)	2347	12.8
105	Sap SE	3508	15559	22.5	ACM-Assoc Comput Mach	5431	34.9	IEEE	3508	22.5
106	The Invention Science Fund 1	3434	24101	14.2	IEEE	3434	14.2	RELX Group (Elsevier)	2752	11.4
107	Boeing Co. (The)	3368	11179	30.1	IEEE	3368	30.1	RELX Group (Elsevier)	1231	11.0
108	Magna International Inc.	3328	5865	56.7	IEEE	3328	56.7	SAE-Society of Automobile Engineers	384	6.5
109	ABB Ltd	3293	5145	64.0	IEEE	3293	64.0	RELX Group (Elsevier)	214	4.2
110	Comcast Corp	3146	11736	26.8	3GPP General Partnership Project Standards Bo	6203	52.9	IEEE	3146	26.8
111	Cirrus Logic Inc.	3114	3825	81.4	IEEE	3114	81.4	Audio Eng Soc	87	2.3
112	Johnson & Johnson	3076	49147	6.3	RELX Group (Elsevier)	9748	19.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5168	10.5
113	Seagate Technology Plc	3040	7365	41.3	IEEE	3040	41.3	American Institute of Physics	1381	18.8
114	Corning Inc.	3032	10064	30.1	IEEE	3032	30.1	Optical Society of America	1284	12.8
115	Chipbond Technology Corp	2928	3666	79.9	IEEE	2928	79.9	RELX Group (Elsevier)	270	7.4
116	Tabula Inc	2903	7804	37.2	IEEE	2903	37.2	ACM-Assoc Comput Mach	2878	36.9
117	Commissariat A L'Energie Ato	2874	10762	26.7	IEEE	2874	26.7	RELX Group (Elsevier)	1988	18.5
118	MicroUnity Systems Engineeri	2812	4592	61.2	IEEE	2812	61.2	Joint IEEE and ACM	407	8.9
119	United States Navy	2810	9480	29.6	IEEE	2810	29.6	American Institute of Physics	1094	11.5
120	Stanford University	2807	22914	12.3	IEEE	2807	12.3	RELX Group (Elsevier)	2779	12.1

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
121	TiVo Corp	2792	10173	27.4	IEEE	2792	27.4	ACM-Assoc Comput Mach	999	9.8
122	Microchip Technology Inc.	2791	4272	65.3	IEEE	2791	65.3	RELX Group (Elsevier)	182	4.3
123	INDIVIDUAL PATENTER	2730	16613	16.4	IEEE	2730	16.4	RELX Group (Elsevier)	2542	15.3
124	Seiko Epson Corporation	2646	7535	35.1	IEEE	2646	35.1	Joint IEEE and ACM	650	8.6
125	Pelican Imaging Corporation	2620	5442	48.1	IEEE	2620	48.1	SPIE-Int Soc Opt Engineering	874	16.1
126	NVIDIA Corp.	2549	6620	38.5	IEEE	2549	38.5	ACM-Assoc Comput Mach	1868	28.2
127	Silicon Laboratories Inc	2530	3230	78.3	IEEE	2530	78.3	RELX Group (Elsevier)	136	4.2
128	II-VI Inc	2418	6565	36.8	IEEE	2418	36.8	IET/IEE	851	13.0
129	Global Foundries Inc	2364	4807	49.2	IEEE	2364	49.2	American Institute of Physics	505	10.5
130	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
131	Rockwell Automation Inc	2260	3242	69.7	IEEE	2260	69.7	RELX Group (Elsevier)	172	5.3
132	University of Michigan	2260	12457	18.1	IEEE	2260	18.1	RELX Group (Elsevier)	2087	16.8
133	Sanken Electric Co. Ltd.	2243	2803	80.0	IEEE	2243	80.0	RELX Group (Elsevier)	331	11.8
134	Juniper Networks Inc.	2212	6610	33.5	IEEE	2212	33.5	Network Working Group RFC	1534	23.2
135	Georgia Institute of Technolog	2192	6669	32.9	IEEE	2192	32.9	RELX Group (Elsevier)	799	12.0
136	ConvergeOne Inc	2189	6591	33.2	IEEE	2189	33.2	Joint IEEE and ACM	973	14.8
137	Arizona State University	2187	6939	31.5	IEEE	2187	31.5	RELX Group (Elsevier)	840	12.1
138	Nuance Communications Inc	2174	5599	38.8	IEEE	2174	38.8	ACM-Assoc Comput Mach	850	15.2
139	University of Texas	2157	15378	14.0	RELX Group (Elsevier)	2531	16.5	IEEE	2157	14.0
140	SIPCO LLC	2141	3527	60.7	IEEE	2141	60.7	ACM-Assoc Comput Mach	272	7.7
141	Bosch (Robert) GmbH	2131	9014	23.6	IEEE	2131	23.6	RELX Group (Elsevier)	804	8.9
142	Hewlett Packard Enterprises	2093	5960	35.1	IEEE	2093	35.1	ACM-Assoc Comput Mach	1588	26.6
143	Cognex Corp.	2089	4706	44.4	IEEE	2089	44.4	RELX Group (Elsevier)	786	16.7
144	University of Washington	2086	12300	17.0	IEEE	2086	17.0	RELX Group (Elsevier)	1804	14.7
145	Innovative Silicon SA	2033	2515	80.8	IEEE	2033	80.8	RELX Group (Elsevier)	108	4.3
146	PACT XPP TECHNOLOGIE	1994	3408	58.5	IEEE	1994	58.5	ACM-Assoc Comput Mach	324	9.5
147	BT Group PLC	1990	4390	45.3	IEEE	1990	45.3	ACM-Assoc Comput Mach	358	8.2
148	PDF Solutions	1983	2580	76.9	IEEE	1983	76.9	SPIE-Int Soc Opt Engineering	394	15.3
149	Lenovo Group Ltd	1949	5471	35.6	3GPP General Partnership Project Standards Bo	2133	39.0	IEEE	1949	35.6
150	Honda Motor Co. Ltd.(Honda	1945	4667	41.7	IEEE	1945	41.7	RELX Group (Elsevier)	652	14.0
151	Intellectual Ventures Manage	1929	3998	48.2	IEEE	1929	48.2	ACM-Assoc Comput Mach	584	14.6
152	Interuniversity MicroElectroni	1889	4223	44.7	IEEE	1889	44.7	American Institute of Physics	396	9.4
153	Mediatek Inc.	1878	3262	57.6	IEEE	1878	57.6	3GPP General Partnership Project Standards Body	800	24.5
154	Flex Ltd (Formerly Flextronics	1877	2549	73.6	IEEE	1877	73.6	CBS Interactive	274	10.7
155	Accenture Ltd.	1851	5584	33.1	IEEE	1851	33.1	ACM-Assoc Comput Mach	1069	19.1
156	Fuji Film Holdings Corp	1846	8221	22.5	IEEE	1846	22.5	ACM-Assoc Comput Mach	1242	15.1
157	Netapp Inc	1832	9582	19.1	ACM-Assoc Comput Mach	4069	42.5	IEEE	1832	19.1
158	Emerson Electric Co.	1811	6674	27.1	IEEE	1811	27.1	RELX Group (Elsevier)	740	11.1
159	FormFactor Inc	1805	3481	51.9	IEEE	1805	51.9	MacMillan Publishing Company	648	18.6
160	CenturyLink Inc	1778	5550	32.0	IEEE	1778	32.0	ACM-Assoc Comput Mach	1002	18.1

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
161	Facebook Inc	1751	5939	29.5	IEEE	1751	29.5	ACM-Assoc Comput Mach	1676	28.2
162	INTOUCH HEALTH INC	1741	3469	50.2	IEEE	1741	50.2	IEEE/RSJ	186	5.4
163	SRI International	1731	4904	35.3	IEEE	1731	35.3	SPIE-Int Soc Opt Engineering	462	9.4
164	Texas A&M University	1679	3616	46.4	IEEE	1679	46.4	RELX Group (Elsevier)	294	8.1
165	Quarterhill Inc	1677	2492	67.3	IEEE	1677	67.3	3GPP General Partnership Project Standards Body	121	4.9
166	TDK Corporation	1638	4649	35.2	IEEE	1638	35.2	American Institute of Physics	844	18.2
167	Wisteria Trading Inc	1602	3168	50.6	IEEE	1602	50.6	SPIE-Int Soc Opt Engineering	357	11.3
168	Citrix Systems Inc	1581	4801	32.9	IEEE	1581	32.9	ACM-Assoc Comput Mach	836	17.4
169	IP RESERVOIR LLC	1573	2865	54.9	IEEE	1573	54.9	ACM-Assoc Comput Mach	511	17.8
170	Walt Disney Co.	1535	5767	26.6	ACM-Assoc Comput Mach	2842	49.3	IEEE	1535	26.6
171	University of Southern Califor	1512	7939	19.0	IEEE	1512	19.0	ACS-Am Chem Soc	1031	13.0
172	SUN PATENT TRUST	1507	5809	25.9	3GPP General Partnership Project Standards Bo	2257	38.9	IEEE	1507	25.9
173	Intertrust Technologies Corp	1498	9661	15.5	ACM-Assoc Comput Mach	1753	18.1	IEEE	1498	15.5
174	Infinera Corporation	1494	2994	49.9	IEEE	1494	49.9	IET/IEE	392	13.1
175	BAE Systems Plc.	1491	2659	56.1	IEEE	1491	56.1	SPIE-Int Soc Opt Engineering	151	5.7
176	Northrop Grumman Corp	1477	3175	46.5	IEEE	1477	46.5	American Institute of Physics	227	7.1
177	NUVOTRONICS INC	1477	1756	84.1	IEEE	1477	84.1	IET/IEE	80	4.6
178	Energous Corporation	1471	1836	80.1	IEEE	1471	80.1	Rajagiri School of Engineering & Technology, Cochin, Kerala, I	172	9.4
179	Toyota Motor Corp	1469	4977	29.5	IEEE	1469	29.5	RELX Group (Elsevier)	1013	20.4
180	Kandou	1441	1487	96.9	IEEE	1441	96.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	19	1.3
181	United Technologies Corp	1424	7640	18.6	IEEE	1424	18.6	NASA-National Aeronautics and Space Admin	861	11.3
182	Brain Corporation	1423	3147	45.2	IEEE	1423	45.2	MIT Press	560	17.8
183	Ignis Innovation Inc	1420	1780	79.8	IEEE	1420	79.8	SID-Society for Information Display	175	9.8
184	Orange	1408	2726	51.7	IEEE	1408	51.7	Internet Soc/IETF-Internet Eng Task Force	157	5.8
185	University of Wisconsin	1398	9390	14.9	IEEE	1398	14.9	ACS-Am Chem Soc	1223	13.0
186	Transphorm Inc	1384	2664	52.0	IEEE	1384	52.0	American Institute of Physics	499	18.7
187	Stryker Corp.	1378	8703	15.8	RELX Group (Elsevier)	1533	17.6	IEEE	1378	15.8
188	Enphase Energy Inc	1333	1475	90.4	IEEE	1333	90.4	IET/IEE	47	3.2
189	Imagination Technologies Gro	1328	3800	34.9	IEEE	1328	34.9	ACM-Assoc Comput Mach	853	22.4
190	LibertyMedia	1326	2358	56.2	IEEE	1326	56.2	ACM-Assoc Comput Mach	162	6.9
191	Viasat	1316	1922	68.5	IEEE	1316	68.5	RELX Group (Elsevier)	83	4.3
192	Purdue University	1314	8906	14.8	RELX Group (Elsevier)	1498	16.8	IEEE	1314	14.8
193	SK Hynix Inc	1313	2389	55.0	IEEE	1313	55.0	American Institute of Physics	139	5.8
194	University of South Florida	1304	4908	26.6	IEEE	1304	26.6	RELX Group (Elsevier)	804	16.4
195	Sonos Inc	1302	2876	45.3	IEEE	1302	45.3	SPIE-Int Soc Opt Engineering	412	14.3
196	illumina Inc.	1300	5846	22.2	IEEE	1300	22.2	RELX Group (Elsevier)	652	11.2
197	FireEye Inc	1297	3377	38.4	IEEE	1297	38.4	ACM-Assoc Comput Mach	678	20.1
198	Battelle Memorial Institute	1291	6031	21.4	IEEE	1291	21.4	RELX Group (Elsevier)	1123	18.6
199	QST Holdings Llc	1280	2189	58.5	IEEE	1280	58.5	Joint IEEE and ACM	241	11.0
200	Eastman Kodak Company	1268	5446	23.3	IEEE	1268	23.3	RELX Group (Elsevier)	522	9.6

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
201	Elwha LLC	1266	3873	32.7	IEEE	1266	32.7	RELX Group (Elsevier)	244	6.3
202	Synaptics Inc.	1260	2315	54.4	IEEE	1260	54.4	ACM-Assoc Comput Mach	123	5.3
203	Maxim Integrated Products Inc	1255	1509	83.2	IEEE	1255	83.2	Texas Instruments	22	1.5
204	Hong Kong University of Scie	1249	2588	48.3	IEEE	1249	48.3	American Institute of Physics	292	11.3
205	United States of America Depa	1248	6730	18.5	RELX Group (Elsevier)	1263	18.8	IEEE	1248	18.5
206	ASM International N.V.	1243	8504	14.6	American Institute of Physics	2117	24.9	RELX Group (Elsevier)	1641	19.3
207	United Microelectronics Corp	1239	2349	52.7	IEEE	1239	52.7	American Institute of Physics	368	15.7
208	Agilent Technologies Inc	1232	4355	28.3	IEEE	1232	28.3	RELX Group (Elsevier)	541	12.4
209	ORIGIN WIRELESS INC	1213	1494	81.2	IEEE	1213	81.2	American Institute of Physics	50	3.3
210	United States Army	1208	4758	25.4	IEEE	1208	25.4	American Institute of Physics	500	10.5
211	Extreme Networks Inc	1206	2626	45.9	IEEE	1206	45.9	ACM-Assoc Comput Mach	291	11.1
212	PHOENIX SOLUTIONS INC	1206	3620	33.3	IEEE	1206	33.3	ISCA (International Speech Communication Association)	478	13.2
213	ATTOPSEMI TECHNOLOG	1201	1522	78.9	IEEE	1201	78.9	IEEE/JPN Soc App Phys	216	14.2
214	Schneider Electric S.A.	1201	6333	19.0	IEEE	1201	19.0	ISA - Instrumentation, Systems & Automation Society	681	10.8
215	Velatia Group	1182	1535	77.0	IEEE	1182	77.0	Echelon Corp	113	7.4
216	Avaya Inc	1168	4021	29.0	IEEE	1168	29.0	Internet Soc/IETF-Internet Eng Task Force	650	16.2
217	Syantec Corp.	1163	4270	27.2	IEEE	1163	27.2	ACM-Assoc Comput Mach	1038	24.3
218	Vanderbilt University	1158	5264	22.0	IEEE	1158	22.0	RELX Group (Elsevier)	785	14.9
219	University of North Carolina	1151	6341	18.2	IEEE	1151	18.2	RELX Group (Elsevier)	774	12.2
220	Mellanox Technologies Ltd	1145	2945	38.9	IEEE	1145	38.9	Joint IEEE and ACM	345	11.7
221	Kyocera Corp.	1130	3755	30.1	3GPP General Partnership Project Standards Bo	1545	41.1	IEEE	1130	30.1
222	National Instruments Corp.	1116	1998	55.9	IEEE	1116	55.9	ACM-Assoc Comput Mach	197	9.9
223	McAfee Inc	1108	4312	25.7	IEEE	1108	25.7	ACM-Assoc Comput Mach	895	20.8
224	eBay Inc	1093	5721	19.1	IEEE	1093	19.1	ACM-Assoc Comput Mach	813	14.2
225	GUIDED THERAPY SYSTE	1084	2787	38.9	IEEE	1084	38.9	RELX Group (Elsevier)	387	13.9
226	Ford Motor Co.	1081	2932	36.9	IEEE	1081	36.9	SAE-Society of Automobile Engineers	437	14.9
227	Washington University in St. L	1081	6121	17.7	IEEE	1081	17.7	RELX Group (Elsevier)	848	13.9
228	Thales	1077	2050	52.5	IEEE	1077	52.5	RELX Group (Elsevier)	122	6.0
229	Math Works Inc (The)	1072	2386	44.9	IEEE	1072	44.9	ACM-Assoc Comput Mach	486	20.4
230	General Motors Corp	1053	4027	26.1	IEEE	1053	26.1	RELX Group (Elsevier)	960	23.8
231	REALTIME DATA LLC	1053	3587	29.4	IEEE	1053	29.4	IBM Corp.	473	13.2
232	Agency for Science Technolog	1052	3347	31.4	IEEE	1052	31.4	RELX Group (Elsevier)	469	14.0
233	Verance Corp	1050	1976	53.1	IEEE	1050	53.1	SPIE-Int Soc Opt Engineering	248	12.6
234	Total SA	1044	1734	60.2	IEEE	1044	60.2	RELX Group (Elsevier)	143	8.2
235	Smith & Nephew Plc.	1043	15016	6.9	RELX Group (Elsevier)	3054	20.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1484	9.9
236	IDC Llc	1040	2900	35.9	IEEE	1040	35.9	SID-Society for Information Display	391	13.5
237	Nielsen Holdings Plc	1039	6677	15.6	IEEE	1039	15.6	RELX Group (Elsevier)	1013	15.2
238	Crossbar Inc	1028	3591	28.6	IEEE	1028	28.6	American Institute of Physics	521	14.5
239	University of Florida	1027	4508	22.8	IEEE	1027	22.8	RELX Group (Elsevier)	738	16.4
240	Carnegie Mellon University	1026	3924	26.1	IEEE	1026	26.1	RELX Group (Elsevier)	424	10.8

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
241	Mevion Medical Systems Inc	1026	3387	30.3	IEEE	1026	30.3	RELX Group (Elsevier)	621	18.3
242	SRC Computers Inc.	1015	1149	88.3	IEEE	1015	88.3	ACM-Assoc Comput Mach	41	3.6
243	Michigan State University	1013	11089	9.1	Optical Society of America	2120	19.1	American Institute of Physics	1554	14.0
244	Johns Hopkins University	1010	6442	15.7	RELX Group (Elsevier)	1104	17.1	IEEE	1010	15.7
245	New Jersey Institute of Techno	986	2508	39.3	IEEE	986	39.3	RELX Group (Elsevier)	551	22.0
246	NETWORK-1 TECHNOLOG	973	2163	45.0	IEEE	973	45.0	ACM-Assoc Comput Mach	596	27.6
247	Schlumberger Ltd.	959	13805	6.9	Society of Petroleum Engineers	3173	23.0	Society of Exploration Geophysicists	2147	15.6
248	University of Nebraska	959	3902	24.6	IEEE	959	24.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	432	11.1
249	Masimo Corp	951	2334	40.7	IEEE	951	40.7	Lippincott Williams & Wilkins Ltd.	213	9.1
250	LivaNova Plc	947	12890	7.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2685	20.8	RELX Group (Elsevier)	2565	19.9
251	BUTTERFLY NETWORKS I	946	1016	93.1	IEEE	946	93.1	Acoustical Society of America	32	3.1
252	TRILLIANT NETWORKS I	944	1393	67.8	IEEE	944	67.8	Internet Soc/IETF-Internet Eng Task Force	93	6.7
253	KLA-Tencor Corp.	923	6934	13.3	SPIE-Int Soc Opt Engineering	1981	28.6	American Institute of Physics	1091	15.7
254	III HOLDINGS 1 LLC	922	1480	62.3	IEEE	922	62.3	ACM-Assoc Comput Mach	177	12.0
255	Align Technology Inc	917	3660	25.1	IEEE	917	25.1	RELX Group (Elsevier)	525	14.3
256	Nantero Inc	913	11219	8.1	ACS-Am Chem Soc	3296	29.4	American Institute of Physics	2353	21.0
257	Midtronics Inc.	911	2127	42.8	IEEE	911	42.8	RELX Group (Elsevier)	363	17.1
258	Cornell University	908	6804	13.3	RELX Group (Elsevier)	1003	14.7	IEEE	908	13.3
259	YFY Inc	903	10322	8.7	SID-Society for Information Display	3816	37.0	National Symposium on Information Display	1136	11.0
260	3M Co	900	22985	3.9	RELX Group (Elsevier)	3373	14.7	Lippincott Williams & Wilkins Ltd.	2108	9.2
261	SYNQOR INC	894	1025	87.2	IEEE	894	87.2	Penton/IPC, Inc.	45	4.4
262	Fortinet Inc	893	1540	58.0	IEEE	893	58.0	ACM-Assoc Comput Mach	207	13.4
263	Skyworks Solutions Inc	888	1203	73.8	IEEE	888	73.8	Summit Technical Media	52	4.3
264	X ONE INC	871	2041	42.7	IEEE	871	42.7	ACM-Assoc Comput Mach	398	19.5
265	Teledyne Technologies Incorp	867	1738	49.9	IEEE	867	49.9	SPIE-Int Soc Opt Engineering	155	8.9
266	Nikon Corp.	861	5115	16.8	SPIE-Int Soc Opt Engineering	2065	40.4	IEEE	861	16.8
267	Deutsche Telekom AG	858	2325	36.9	IEEE	858	36.9	3GPP General Partnership Project Standards Body	264	11.4
268	Northwestern University	858	12006	7.1	ACS-Am Chem Soc	2678	22.3	RELX Group (Elsevier)	1476	12.3
269	BIOSENSORS INTERNATI	854	2635	32.4	IEEE	854	32.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	372	14.1
270	Cleveland Clinic (and Foundat	850	4325	19.7	IEEE	850	19.7	RELX Group (Elsevier)	839	19.4
271	Duke University	834	5138	16.2	IEEE	834	16.2	RELX Group (Elsevier)	670	13.0
272	Technion - Israel Institute of T	830	2386	34.8	IEEE	830	34.8	RELX Group (Elsevier)	268	11.2
273	Cortica Ltd	819	1085	75.5	IEEE	819	75.5	ACM-Assoc Comput Mach	105	9.7
274	Synergy Microwave Corp	817	985	82.9	IEEE	817	82.9	Horizon House Publications	66	6.7
275	Lam Research Corp.	816	4478	18.2	American Institute of Physics	1285	28.7	IEEE	816	18.2
276	HTC Corporation	809	3697	21.9	3GPP General Partnership Project Standards Bo	2142	57.9	IEEE	809	21.9
277	Airbus SE	795	1905	41.7	IEEE	795	41.7	RELX Group (Elsevier)	222	11.7
278	University of Pennsylvania	792	7714	10.3	RELX Group (Elsevier)	1141	14.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	849	11.0
279	Integrated Device Technology	790	1067	74.0	IEEE	790	74.0	Joint IEEE and ACM	27	2.5
280	VIVAQUANT LLC	785	1244	63.1	IEEE	785	63.1	RELX Group (Elsevier)	102	8.2

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281	Voxer Llc	779	1274	61.1	IEEE	779	61.1	Internet Soc/IETF-Internet Eng Task Force	93	7.3
282	Otto Bock Holding GmbH &	778	1527	50.9	IEEE	778	50.9	RELX Group (Elsevier)	220	14.4
283	Viavi Solutions Inc	774	2601	29.8	IEEE	774	29.8	American Institute of Physics	404	15.5
284	State University of New York	772	4241	18.2	IEEE	772	18.2	RELX Group (Elsevier)	629	14.8
285	University of Maryland	772	4409	17.5	IEEE	772	17.5	RELX Group (Elsevier)	686	15.6
286	GoPro Inc	769	1158	66.4	IEEE	769	66.4	ACM-Assoc Comput Mach	129	11.1
287	Knowles Corp	769	1517	50.7	IEEE	769	50.7	RELX Group (Elsevier)	172	11.3
288	PixelWorks Inc	766	1162	65.9	IEEE	766	65.9	SPIE-Int Soc Opt Engineering	109	9.4
289	Zebra Technologies Corp.	761	1520	50.1	IEEE	761	50.1	RELX Group (Elsevier)	71	4.7
290	Princeton University	757	6165	12.3	American Institute of Physics	1379	22.4	IEEE	757	12.3
291	Power Integrations Inc.	756	1151	65.7	IEEE	756	65.7	Penton/IPC, Inc.	72	6.3
292	Charles Stark Draper Laborato	752	2371	31.7	IEEE	752	31.7	RELX Group (Elsevier)	284	12.0
293	Harvard University	751	11615	6.5	ACS-Am Chem Soc	1500	12.9	RELX Group (Elsevier)	1416	12.2
294	Ecole Polytechnique Federale	748	2452	30.5	IEEE	748	30.5	RELX Group (Elsevier)	237	9.7
295	Aisin Seiki Co. Ltd.	733	5178	14.2	Optical Society of America	1808	34.9	IEEE	733	14.2
296	Headwater Partners 1 LLC	731	1618	45.2	IEEE	731	45.2	ACM-Assoc Comput Mach	315	19.5
297	M/A-COM Technology Soluti	728	1498	48.6	IEEE	728	48.6	American Institute of Physics	190	12.7
298	Round Rock Research LLC	725	2229	32.5	IEEE	725	32.5	RELX Group (Elsevier)	352	15.8
299	AMS AG	724	3560	20.3	American Institute of Physics	916	25.7	IEEE	724	20.3
300	Avid Technology Inc.	710	1712	41.5	IEEE	710	41.5	ACM-Assoc Comput Mach	618	36.1
301	NUMENTA INC	706	2664	26.5	Numenta Inc.	919	34.5	IEEE	706	26.5
302	JPMorgan	704	6084	11.6	Source Media	1135	18.7	IEEE	704	11.6
303	BANDSPEED INC	696	1046	66.5	IEEE	696	66.5	Bluetooth Special Interest Group	262	25.0
304	Silverbrook Pty Ltd	691	1966	35.1	IEEE	691	35.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	440	22.4
305	Advantest Corp.	686	964	71.2	IEEE	686	71.2	American Institute of Physics	41	4.3
306	General Dynamics Corp	686	1643	41.8	IEEE	686	41.8	American Physical Society	248	15.1
307	Ciena Corp	684	2122	32.2	IEEE	684	32.2	Optical Society of America	323	15.2
308	Pioneer Corp.	680	1518	44.8	IEEE	680	44.8	SPIE-Int Soc Opt Engineering	273	18.0
309	ZTE Microelectronics Technol	678	3392	20.0	3GPP General Partnership Project Standards Bo	1834	54.1	IEEE	678	20.0
310	Yageo Corporation	674	888	75.9	IEEE	674	75.9	IET/IEE	183	20.6
311	Johnson Controls International	668	1850	36.1	IEEE	668	36.1	RELX Group (Elsevier)	273	14.8
312	ASML Holding NV	665	13107	5.1	SPIE-Int Soc Opt Engineering	4532	34.6	American Institute of Physics	2876	21.9
313	NOMADIX INC	663	2543	26.1	IEEE	663	26.1	Network Working Group RFC	410	16.1
314	North Carolina State Universit	662	4197	15.8	American Institute of Physics	780	18.6	IEEE	662	15.8
315	EchoStar Corp	659	1214	54.3	IEEE	659	54.3	RELX Group (Elsevier)	78	6.4
316	Tel Aviv University	654	4098	16.0	IEEE	654	16.0	RELX Group (Elsevier)	644	15.7
317	Palantir Technologies Inc	647	2353	27.5	ACM-Assoc Comput Mach	664	28.2	IEEE	647	27.5
318	Centre National De La Recher	646	6240	10.4	RELX Group (Elsevier)	1599	25.6	IEEE	646	10.4
319	Virginia Tech University	643	2147	29.9	IEEE	643	29.9	RELX Group (Elsevier)	301	14.0
320	NXGEN PARTNERS IP LLC	633	1346	47.0	IEEE	633	47.0	Optical Society of America	349	25.9

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321	Korea Advanced Institute for S	627	1893	33.1	IEEE	627	33.1	RELX Group (Elsevier)	191	10.1
322	Schweitzer Engineering Labor	627	742	84.5	IEEE	627	84.5	RELX Group (Elsevier)	19	2.6
323	MULTI-TECH SYSTEMS IN	626	971	64.5	IEEE	626	64.5	International Telecommunication Union	52	5.4
324	Sulvolta Inc	620	1301	47.7	IEEE	620	47.7	American Institute of Physics	200	15.4
325	PSEMI CORP	618	700	88.3	IEEE	618	88.3	RELX Group (Elsevier)	12	1.7
326	MOJO MOBILITY INC	616	786	78.4	IEEE	616	78.4	RELX Group (Elsevier)	54	6.9
327	ACORN TECHNOLOGIES I	614	1740	35.3	IEEE	614	35.3	American Institute of Physics	516	29.7
328	National Chiao Tung Universit	613	1183	51.8	IEEE	613	51.8	American Institute of Physics	101	8.5
329	Sotera Wireless	605	1157	52.3	IEEE	605	52.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	182	15.7
330	Fastback Networks Inc	596	837	71.2	IEEE	596	71.2	IET/IEE	57	6.8
331	Unisantis Electronics Ltd	593	699	84.8	IEEE	593	84.8	RELX Group (Elsevier)	38	5.4
332	Fujitsu Semiconductor Ltd	589	964	61.1	IEEE	589	61.1	IEEE/JPN Soc App Phys	66	6.8
333	New York University	589	3165	18.6	IEEE	589	18.6	Optical Society of America	316	10.0
334	University of Alabama	589	3456	17.0	RELX Group (Elsevier)	745	21.6	IEEE	589	17.0
335	Denso Corp	586	1307	44.8	IEEE	586	44.8	RELX Group (Elsevier)	119	9.1
336	Oki Electric Industry Co. Ltd.	584	1387	42.1	IEEE	584	42.1	IEICE-Inst Elec Info Comm Eng	153	11.0
337	EXEGY INC	577	1124	51.3	IEEE	577	51.3	ACM-Assoc Comput Mach	184	16.4
338	Micro Focus International PL	577	1764	32.7	IEEE	577	32.7	ACM-Assoc Comput Mach	429	24.3
339	AMPT LLC	575	715	80.4	IEEE	575	80.4	IET/IEE	38	5.3
340	Nintendo Co. Ltd.	573	3222	17.8	ACM-Assoc Comput Mach	755	23.4	IEEE	573	17.8
341	Halliburton Co. (Holding)	571	9043	6.3	Society of Petroleum Engineers	3361	37.2	RELX Group (Elsevier)	724	8.0
342	Screen Holdings Co Ltd (Form	569	2143	26.6	IEEE	569	26.6	RELX Group (Elsevier)	315	14.7
343	Maxlinear Inc	568	770	73.8	IEEE	568	73.8	ACM-Assoc Comput Mach	41	5.3
344	Soitec SA	565	2112	26.8	IEEE	565	26.8	American Institute of Physics	511	24.2
345	3D Systems Corp.	564	1325	42.6	IEEE	564	42.6	ACM-Assoc Comput Mach	314	23.7
346	University of Virginia (and Pat	560	2281	24.6	IEEE	560	24.6	RELX Group (Elsevier)	313	13.7
347	University of Pittsburgh	555	4473	12.4	RELX Group (Elsevier)	907	20.3	IEEE	555	12.4
348	Eaton Corp.	553	788	70.2	IEEE	553	70.2	RELX Group (Elsevier)	36	4.6
349	The National Aeronautical and	552	2857	19.3	IEEE	552	19.3	AIAA-Am Inst Aero Astro	288	10.1
350	University of Arizona	551	2289	24.1	IEEE	551	24.1	Optical Society of America	436	19.0
351	Soraa Inc	550	6001	9.2	American Institute of Physics	2067	34.4	Institute of Pure and Applied Physics	1028	17.1
352	MegaChips Corp	549	830	66.1	IEEE	549	66.1	American Physical Society	51	6.1
353	Virgin Islands Microsystems	548	2251	24.3	IEEE	548	24.3	American Institute of Physics	461	20.5
354	VerintSys	546	4524	12.1	International Data Group	1318	29.1	ACM-Assoc Comput Mach	921	20.4
355	P4TENTS1 LLC	544	942	57.7	IEEE	544	57.7	ACM-Assoc Comput Mach	115	12.2
356	FARO Technologies Inc.	538	1315	40.9	IEEE	538	40.9	SPIE-Int Soc Opt Engineering	208	15.8
357	GENGHISCOMM HOLDIN	537	579	92.7	IEEE	537	92.7	IET/IEE	14	2.4
358	Global Tel Link Corp	532	735	72.4	IEEE	532	72.4	IEEE/Eurasip	38	5.2
359	HEMOSONICS LLC	531	914	58.1	IEEE	531	58.1	RELX Group (Elsevier)	92	10.1
360	Sumitomo Electric Industries	531	3594	14.8	IEEE	531	14.8	American Institute of Physics	481	13.4

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
361	VirnetX Holding Corp	527	9087	5.8	Network Working Group RFC	4570	50.3	Internet Soc/IETF-Internet Eng Task Force	1540	16.9
362	Proteus Biomedical Inc	525	2203	23.8	IEEE	525	23.8	RELX Group (Elsevier)	390	17.7
363	Via Technologies Inc.	525	1119	46.9	IEEE	525	46.9	Joint IEEE and ACM	152	13.6
364	IDEMIA	524	1292	40.6	IEEE	524	40.6	RELX Group (Elsevier)	96	7.4
365	Ohio State University	523	2854	18.3	IEEE	523	18.3	RELX Group (Elsevier)	478	16.7
366	Maui Diagnostic Imaging	522	648	80.6	IEEE	522	80.6	RELX Group (Elsevier)	40	6.2
367	Xtera Communications Inc.	521	1535	33.9	IEEE	521	33.9	IET/IEE	359	23.4
368	Aerospace Corp.	519	1266	41.0	IEEE	519	41.0	RELX Group (Elsevier)	171	13.5
369	Hoya Corp	519	1789	29.0	IEEE	519	29.0	American Institute of Physics	343	19.2
370	Ossur hf	518	1355	38.2	IEEE	518	38.2	RELX Group (Elsevier)	266	19.6
371	PLUSN LLC	518	697	74.3	IEEE	518	74.3	IET/IEE	68	9.8
372	Emcore Corp.	517	1147	45.1	IEEE	517	45.1	American Institute of Physics	162	14.1
373	Olympus Corp.	516	2729	18.9	IEEE	516	18.9	RELX Group (Elsevier)	415	15.2
374	Pulse Link Inc	516	630	81.9	IEEE	516	81.9	Scientific American Inc.	24	3.8
375	University of Central Florida	513	3930	13.1	RELX Group (Elsevier)	540	13.7	IEEE	513	13.1
376	CREATIVE KINGDOMS LL	512	1655	30.9	IEEE	512	30.9	ACM-Assoc Comput Mach	447	27.0
377	Realtek Semiconductor Corp.	512	615	83.3	IEEE	512	83.3	ACM-Assoc Comput Mach	15	2.4
378	University of Utah	510	3129	16.3	IEEE	510	16.3	RELX Group (Elsevier)	421	13.5
379	Assa Abloy AB	509	3123	16.3	IEEE	509	16.3	International Association for Cryptologic Research (IACR)	403	12.9
380	ECOLE DE TECHBOLOGIE	508	741	68.6	IEEE	508	68.6	3GPP General Partnership Project Standards Body	54	7.3
381	Omnivision Technologies Inc	507	1206	42.0	IEEE	507	42.0	Optical Society of America	289	24.0
382	City University of Hong Kong	500	1273	39.3	IEEE	500	39.3	RELX Group (Elsevier)	113	8.9
383	MC10 Inc	499	5475	9.1	American Institute of Physics	1067	19.5	ACS-Am Chem Soc	812	14.8
384	Pennsylvania State University	498	3347	14.9	RELX Group (Elsevier)	613	18.3	IEEE	498	14.9
385	HMD Global	497	976	50.9	IEEE	497	50.9	3GPP General Partnership Project Standards Body	91	9.3
386	ST-Ericsson SA (Patents split	496	700	70.9	IEEE	496	70.9	3GPP General Partnership Project Standards Body	83	11.9
387	University of Colorado (The	496	3484	14.2	Optical Society of America	802	23.0	IEEE	496	14.2
388	Dassault Systemes SA	493	3529	14.0	RELX Group (Elsevier)	708	20.1	IEEE	493	14.0
389	Comtech Telecommunications	492	1036	47.5	IEEE	492	47.5	3GPP General Partnership Project Standards Body	218	21.0
390	Medispectra Inc	480	1291	37.2	IEEE	480	37.2	RELX Group (Elsevier)	146	11.3
391	ZENA TECHNOLOGIES IN	480	1830	26.2	IEEE	480	26.2	American Institute of Physics	393	21.5
392	PME IP PTY LTD	479	930	51.5	IEEE	479	51.5	ACM-Assoc Comput Mach	239	25.7
393	Tellabs Inc.	479	1052	45.5	IEEE	479	45.5	Internet Soc/IETF-Internet Eng Task Force	172	16.3
394	Vestas Wind Systems A/S	479	982	48.8	IEEE	479	48.8	AWEA-American Wind Energy Association	98	10.0
395	Cheetah Omni LLC	478	1872	25.5	IEEE	478	25.5	Optical Society of America	445	23.8
396	MACAU UNIVERSITY OF S	477	626	76.2	IEEE	477	76.2	ACM-Assoc Comput Mach	28	4.5
397	ETA DEVICES INC	476	545	87.3	IEEE	476	87.3	IET/IEE	20	3.7
398	Tokyo Electron Limited	476	3760	12.7	RELX Group (Elsevier)	531	14.1	American Institute of Physics	520	13.8
399	Lumentum Holdings Inc	472	1615	29.2	IEEE	472	29.2	Optical Society of America	376	23.3
400	MIRAMAR LABS INC	472	1122	42.1	IEEE	472	42.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	125	11.1

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
401	Lattice Semiconductor Corp.	471	680	69.3	IEEE	471	69.3	Joint IEEE and ACM	39	5.7
402	Qinetiq Group Ltd	469	1551	30.2	IEEE	469	30.2	American Institute of Physics	168	10.8
403	NCR Corp.	468	1541	30.4	IEEE	468	30.4	ACM-Assoc Comput Mach	334	21.7
404	F5 Networks Inc	467	2493	18.7	IEEE	467	18.7	ACM-Assoc Comput Mach	406	16.3
405	Tigo Energy Inc	465	644	72.2	IEEE	465	72.2	WIP-Renewable Energies	134	20.8
406	UT-Battelle LLC	463	3959	11.7	RELX Group (Elsevier)	720	18.2	American Institute of Physics	503	12.7
407	MicroStrategy Inc.	462	1849	25.0	IEEE	462	25.0	United Business Media/UBM Tech	359	19.4
408	National Taiwan University	459	909	50.5	IEEE	459	50.5	American Institute of Physics	73	8.0
409	Ligado Networks (formerly Li	453	846	53.5	IEEE	453	53.5	Baltzer Science Publishers B.V.	130	15.4
410	Autodesk Inc.	450	3114	14.5	ACM-Assoc Comput Mach	1954	62.7	IEEE	450	14.5
411	SAS Institute	450	1491	30.2	IEEE	450	30.2	RELX Group (Elsevier)	192	12.9
412	Commonwealth Scientific and	449	1056	42.5	IEEE	449	42.5	RELX Group (Elsevier)	118	11.2
413	Oewaves Inc	447	1412	31.7	Optical Society of America	537	38.0	IEEE	447	31.7
414	ALOFT MEDIA LLC	446	668	66.8	IEEE	446	66.8	3GPP General Partnership Project Standards Body	105	15.7
415	Dialog Semiconductor Plc.	446	517	86.3	IEEE	446	86.3	ONLINE INC	18	3.5
416	Asahi Kasei Corp.	443	6163	7.2	RELX Group (Elsevier)	1446	23.5	Lippincott Williams & Wilkins Ltd.	861	14.0
417	Fortive Corporation	443	1113	39.8	IEEE	443	39.8	RELX Group (Elsevier)	116	10.4
418	ValenceI Inc	443	874	50.7	IEEE	443	50.7	RELX Group (Elsevier)	53	6.1
419	William Marsh Rice Universit	435	3879	11.2	ACS-Am Chem Soc	755	19.5	RELX Group (Elsevier)	512	13.2
420	Cubic Corporation	434	597	72.7	IEEE	434	72.7	ACM-Assoc Comput Mach	19	3.2
421	Eagleview Technologies Inc	432	1268	34.1	IEEE	432	34.1	ACM-Assoc Comput Mach	233	18.4
422	Telecom Italia SPA	432	1063	40.6	IEEE	432	40.6	3GPP General Partnership Project Standards Body	150	14.1
423	University of New Mexico	431	2182	19.8	IEEE	431	19.8	American Institute of Physics	244	11.2
424	Carl-Zeiss Stiftung	428	8729	4.9	SPIE-Int Soc Opt Engineering	1665	19.1	Optical Society of America	1409	16.1
425	Teradyne Inc.	428	836	51.2	IEEE	428	51.2	ASME-Am Soc Mech Eng	98	11.7
426	SAIC Inc	427	2618	16.3	SPIE-Int Soc Opt Engineering	572	21.8	IEEE	427	16.3
427	ICOSYSTEM CORP	426	577	73.8	IEEE	426	73.8	RELX Group (Elsevier)	27	4.7
428	EDGE 3 TECHNOLOGIES I	425	646	65.8	IEEE	425	65.8	International Association for Pattern Recognition (IAPR)	45	7.0
429	THE FLORIDA INTERNATI	425	1117	38.0	IEEE	425	38.0	RELX Group (Elsevier)	142	12.7
430	Ceva Inc.	423	763	55.4	IEEE	423	55.4	ACM-Assoc Comput Mach	82	10.7
431	Alstom	422	689	61.2	IEEE	422	61.2	ASME-Am Soc Mech Eng	55	8.0
432	University of Connecticut	422	2313	18.2	IEEE	422	18.2	RELX Group (Elsevier)	416	18.0
433	Vicor Corp	420	519	80.9	IEEE	420	80.9	Center for Power Electronics Systems (Virginia Tech)	42	8.1
434	Becton Dickinson and Co.	419	23152	1.8	RELX Group (Elsevier)	3871	16.7	Wolters Kluwer	3238	14.0
435	IPCO LLC	417	732	57.0	IEEE	417	57.0	ACM-Assoc Comput Mach	54	7.4
436	Densbits Technologies Ltd	414	767	54.0	IEEE	414	54.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	119	15.5
437	TRACBEAM LLC	414	799	51.8	IEEE	414	51.8	ACM-Assoc Comput Mach	108	13.5
438	Nant Holdings IP Llc	413	2165	19.1	Joint IEEE and ACM	811	37.5	ACM-Assoc Comput Mach	531	24.5
439	Fuji Electric Holdings Co. Ltd.	412	880	46.8	IEEE	412	46.8	American Institute of Physics	123	14.0
440	SiOnyx Inc	410	2010	20.4	American Institute of Physics	750	37.3	IEEE	410	20.4

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441	AB Initio Technology LLC	408	1215	33.6	IEEE	408	33.6	ACM-Assoc Comput Mach	405	33.3
442	ACACIA MEDIA TECHNOL	408	738	55.3	IEEE	408	55.3	ACM-Assoc Comput Mach	66	8.9
443	Here Global BV	407	823	49.5	IEEE	407	49.5	ACM-Assoc Comput Mach	109	13.2
444	Drexel University	406	3769	10.8	RELX Group (Elsevier)	880	23.3	American Institute of Physics	729	19.3
445	National University of Ireland	406	805	50.4	IEEE	406	50.4	RELX Group (Elsevier)	61	7.6
446	A10 Networks Inc	404	663	60.9	IEEE	404	60.9	Joint IEEE and ACM	94	14.2
447	University of Tennessee Resea	403	1966	20.5	IEEE	403	20.5	RELX Group (Elsevier)	316	16.1
448	United States of America Depa	402	1982	20.3	IEEE	402	20.3	American Institute of Physics	345	17.4
449	FACENSE LTD	401	482	83.2	IEEE	401	83.2	ACM-Assoc Comput Mach	56	11.6
450	Hexagon AB	401	1154	34.7	IEEE	401	34.7	ACM-Assoc Comput Mach	120	10.4
451	NATIONAL TECHNOLOG	401	1313	30.5	IEEE	401	30.5	RELX Group (Elsevier)	154	11.7
452	Ygomi LLC	401	439	91.3	IEEE	401	91.3	SPIE-Int Soc Opt Engineering	15	3.4
453	Omni Ai Inc. Inc (formerly BR	396	458	86.5	IEEE	396	86.5	International Association for Pattern Recognition (IAPR)	51	11.1
454	Hologic Inc	393	4497	8.7	RELX Group (Elsevier)	873	19.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	735	16.3
455	Vishay Intertechnology Inc.	393	585	67.2	IEEE	393	67.2	RELX Group (Elsevier)	38	6.5
456	SolAero Technologies Corp	392	586	66.9	IEEE	392	66.9	American Institute of Physics	93	15.9
457	Coherent Inc.	391	2763	14.2	Optical Society of America	558	20.2	American Institute of Physics	508	18.4
458	Furukawa Electric Co. Ltd.	391	1893	20.7	Optical Society of America	434	22.9	IEEE	391	20.7
459	AVISTAR COMMUNICATI	390	777	50.2	IEEE	390	50.2	ACM-Assoc Comput Mach	228	29.3
460	Continental AG (Germany Fed	390	776	50.3	IEEE	390	50.3	RELX Group (Elsevier)	53	6.8
461	ITT Corp	390	863	45.2	IEEE	390	45.2	Internet Soc/IETF-Internet Eng Task Force	63	7.3
462	United States Air Force	390	1616	24.1	IEEE	390	24.1	American Institute of Physics	182	11.3
463	ON-RAMP WIRELESS INC	389	569	68.4	IEEE	389	68.4	IET/IEE	48	8.4
464	YANICKLO TECHNOLOG	389	2412	16.1	ACM-Assoc Comput Mach	854	35.4	IEEE	389	16.1
465	Catholic University Leuven	388	1063	36.5	IEEE	388	36.5	American Institute of Physics	126	11.9
466	Communications Research Ce	388	602	64.5	IEEE	388	64.5	IET/IEE	43	7.1
467	NEWRACOM Inc	388	396	98.0	IEEE	388	98.0	SPIE-Int Soc Opt Engineering	4	1.0
468	Seoul National University	387	1493	25.9	IEEE	387	25.9	ACS-Am Chem Soc	178	11.9
469	BLUERISC INC	386	1082	35.7	IEEE	386	35.7	Joint IEEE and ACM	258	23.8
470	IWALK INC	385	1024	37.6	IEEE	385	37.6	RELX Group (Elsevier)	207	20.2
471	BIO CONTROL MEDICAL (383	1409	27.2	IEEE	383	27.2	Lippincott Williams & Wilkins Ltd.	221	15.7
472	TE Connectivity Ltd	382	991	38.5	IEEE	382	38.5	Optical Society of America	112	11.3
473	Caterpillar Inc.	378	1123	33.7	IEEE	378	33.7	SAE-Society of Automobile Engineers	158	14.1
474	Concormis Inc	375	10887	3.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1734	15.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1452	13.3
475	HeartFlow Inc	374	2236	16.7	Springer/Sp. Wien/Springer-Verlag/KluwAcad	540	24.2	RELX Group (Elsevier)	435	19.5
476	Kofax Inc	373	910	41.0	IEEE	373	41.0	ACM-Assoc Comput Mach	142	15.6
477	Rohm Co. Ltd.	373	3221	11.6	American Institute of Physics	902	28.0	RELX Group (Elsevier)	442	13.7
478	ZOOX INC	373	461	80.9	IEEE	373	80.9	IEEE/RSJ	31	6.7
479	Japan Science and Technology	371	4113	9.0	American Institute of Physics	1119	27.2	RELX Group (Elsevier)	549	13.3
480	OVONYX MEMORY TECH	371	467	79.4	IEEE	371	79.4	IEEE/JPN Soc App Phys	45	9.6

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481	Atos SE	369	910	40.5	IEEE	369	40.5	Internet Soc/IETF-Internet Eng Task Force	132	14.5
482	Magic Leap Inc	365	849	43.0	IEEE	365	43.0	Optical Society of America	61	7.2
483	SalesforceCom Inc	365	954	38.3	IEEE	365	38.3	ACM-Assoc Comput Mach	258	27.0
484	ZF Friedrichshafen AG (Germ	365	942	38.7	IEEE	365	38.7	American Institute of Physics	81	8.6
485	SYNTROPY SYSTEMS LLC	364	405	89.9	IEEE	364	89.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	18	4.4
486	University of Rochester	364	2678	13.6	IEEE	364	13.6	Optical Society of America	344	12.8
487	Yonsei University	364	923	39.4	IEEE	364	39.4	RELX Group (Elsevier)	100	10.8
488	OMNI MEDSCI INC	362	2463	14.7	Optical Society of America	677	27.5	IEEE	362	14.7
489	Sigma Corp	362	480	75.4	IEEE	362	75.4	SPIE-Int Soc Opt Engineering	70	14.6
490	University of Notre Dame Du	362	686	52.8	IEEE	362	52.8	ACS-Am Chem Soc	38	5.5
491	INTERVAL RESEARCH CO	361	901	40.1	IEEE	361	40.1	ACM-Assoc Comput Mach	235	26.1
492	University Health Network	360	1084	33.2	IEEE	360	33.2	RELX Group (Elsevier)	161	14.9
493	Avalanche Technology Inc	359	1592	22.6	American Institute of Physics	499	31.3	IEEE	359	22.6
494	Seoul Semiconductor Co Ltd	359	2697	13.3	American Institute of Physics	1088	40.3	IEEE	359	13.3
495	University of Massachusetts	359	3063	11.7	ACS-Am Chem Soc	428	14.0	RELX Group (Elsevier)	370	12.1
496	National University of Singapo	356	1398	25.5	IEEE	356	25.5	RELX Group (Elsevier)	179	12.8
497	Council of Scientific and Indus	353	1406	25.1	IEEE	353	25.1	RELX Group (Elsevier)	309	22.0
498	Jiangsu ChangJiang Electronic	353	445	79.3	IEEE	353	79.3	International Microelectronics And Packaging Society	40	9.0
499	Roche Holding Ltd.	353	7895	4.5	RELX Group (Elsevier)	1752	22.2	ACS-Am Chem Soc	928	11.8
500	Khalifa University of Science	352	471	74.7	IEEE	352	74.7	RELX Group (Elsevier)	17	3.6