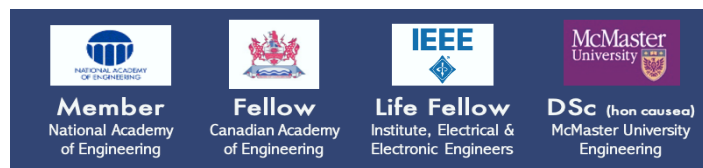


**Waguih S Ishak, Ph.D.**

1 (650) 283-5501

[waguih.ishak@gmail.com](mailto:waguih.ishak@gmail.com)**PROFESSIONAL SUMMARY & HONORS**

- Experienced chief Technologist with solid track record of building global R&D organizations at scale with teamwork culture.
- Evangelist and leader in technology management and innovations.
- Strong connections with VCs, startups, academia and national labs.
- My teams (at four companies) generated >1000 patents and transferred R&D technologies with multi \$ Billion in revenues.

**TECHNICAL SKILLS**

- Integrated photonics & optoelectronics.
- High-speed mixed signal ICs.
- Display technologies.
- Metamaterials.
- Semiconductor devices.
- Acoustic devices.

**SOFT SKILLS**

- Chief technologist.
- Evangelist for R&D innovations.
- Moves technology from R to D to M.
- Organization builder & connector.
- Coach & Mentor.
- Evaluating startups.
- Motivating global speaker.

**HIGHLIGHTS OF MY QUALIFICATIONS****1. BUILDING GLOBAL R&D ORGANIZATIONS:**

- 2007 - Established the Corning West Technology Center, Corning (Palo Alto & Sunnyvale).
- 2005 - Established the US R&D Center, Avago (Now Broadcom) Technologies (San Jose).
- 2002 - Established the Communications & Optics Research Lab, Agilent Technologies (Palo Alto).
- 1999 - Established the Photonics & Electronics Lab, Hewlett-Packard (Palo Alto, Colorado Springs).
- 1999 - Established the Japan Tech Center, Hewlett-Packard (Tokyo).
- 1999 - Established the Peking Tech Center, Agilent Technologies (Peking).

- 1998 - Founded the Stanford Photonics Research Center (Stanford).

## **2. INVENTING & INNOVATING IN R&D (Examples from my teams):**

- 2012 - Developed 10 and 20Gb/s Active Optical Cable (USB3.0 & Thunderbolt).
- 2003 - Invented and developed the Laser Mouse; the world's best trademark of pointing devices.
- 2000 - Set up the world's first Vertical Cavity Surface Emitting Laser (VCSEL) manufacturing entity.
- 1999 - Developed the world's first Optical Mouse engine.
- 1999 - Invented & developed the world's first parallel optical interconnects (12 Gb/s & 40 Gb/s).
- 1986-2002 - Invented & developed photonic/electronic technologies for more than 20 optical test and measurement products.
- 1984 - Developed Surface Acoustic Wave (SAW) low-loss filters for microwave spectrum analyzers.

## **3. MOVING RESEARCH RESULTS TO DEVELOPMENT & MANUFACTURING:**

- Leadership to design and develop more than 20 optical test instruments in the 1980s to test the early fiber optic components and networks. Four business units were created to commercialize our technologies with multi billion dollars of revenues:  
<http://hparchive.com/Journals/HPJ-1991-02.pdf>  
<http://hparchive.com/Journals/HPJ-1993-02.pdf>  
<http://hparchive.com/Journals/HPJ-1995-02.pdf>  
<http://hparchive.com/Journals/HPJ-1997-12.pdf>
- Leadership to develop the world's first commercial vertical cavity surface emitting lasers (VCSELs) with the most valuable patents in the VCSEL area:  
<https://patents.justia.com/patent/5359447>  
<https://ieeexplore.ieee.org/document/612455>
- Leadership in inventing, developing, and manufacturing the industry's first laser mouse with multibillion units sold:  
[https://www.agilent.com/labs/features/2005\\_ieeefellows.html](https://www.agilent.com/labs/features/2005_ieeefellows.html)  
<http://archive.computerhistory.org/resources/access/text/2017/10/102738447-05-01-acc.pdf>  
<https://www.investor.agilent.com/news-and-events/news/news-details/2005/Agilent-Technologies-Ships-400-Millionth-Optical-Mouse-Sensor/default.aspx>
- Leadership to coin and promote the "Tera Era" term and build the world's first parallel optical interconnects modules at 30 and 120 Gb/s:  
<https://www.spiedigitallibrary.org/conference-proceedings-of-spie/4533/1/High-speed-VCSEL-based-optical-interconnects/10.1117/12.447769.short>

## **4. PROMOTING PHOTONICS AS ESSENTIAL TECHNOLOGY FOR THE USA:**

- A member of the US National Academies' Committee on Harnessing the Light for 21<sup>st</sup> Century. Released a landmark report (Optics & Photonics: Essential Technologies for Our Nation) discussing the current state of optical sciences and goals for the future:  
<https://www.nap.edu/read/13491/chapter/1#ii>
- The Harnessing Light committee members also made several specific recommendations on how to best capitalize on the opportunities optics and photonics provides, resulting in establishing the Photonics Manufacturing Institute (now AIM Photonics) in 2014:  
<https://spie.org/news/1003-imi-white-house-ancmt?SSO=1>

## WORK EXPERIENCE

**July 2018 - Present**

**STANFORD UNIVERSITY**

*Adjunct Professor, Department of Electrical Engineering Stanford University, CA*

**May 2016 - Present**

**CORNING, INCORPORATED**

*Division VP & Chief Technologist, Corning Research & Development Corporation, Sunnyvale, CA*

<https://www.nist.gov/director/vcat/biography-dr-waguih-ishak>

- Responsible for charting a Growth Path through Innovation:
  - Identifying new directions and the technologies needed to chart the path.
  - Identifying startups for investments and/or acquisition. % companies acquired.
  - Defining an innovation model to take technology from concepts to commercialization.
  - Identifying and hiring top notch scientists from top schools.
  - Identified and joined a Venture Partner as an LP.

**July 2007 - May 2016**

**CORNING, INCORPORATED**

*Division Vice President and Director, Corning West Technology Center (CWTC), Palo Alto, CA*

[http://www.businessweek.com/magazine/content/08\\_52/b4114086632687.htm](http://www.businessweek.com/magazine/content/08_52/b4114086632687.htm)

- Founded a state-of-the-art technology center from the grounds up:
  - Set up the mission and thrusts for the CWTC: to develop state-of-the-art technologies and applications in the areas of energy, displays and high-speed communications.
  - Generated a strategy document for CWTC.
  - Established a state-of-the-art research facility in Palo Alto.
    - <https://www.youtube.com/watch?v=4Vd9EDhQp3E>
  - Recruited and hired top scientists and engineers from top universities.
  - Developed a research agenda and is managing the center.
- Responsible for creating partnerships with West Coast companies and universities in the following areas:
  - Advanced displays.
  - Ultra-high-speed optical interconnects.
  - Fiber-optic consumer applications.
- Responsible for managing a research portfolio in the following areas:
  - Novel photonic multi-touch technology.
  - Integrated multi-touch sensors for touch screens.
  - Low-power backlighting.
  - High-speed fiber Active Cable Assembly for USB3.0 and Thunderbolt Standards.
  - Novel thermal solar subsystems.
- Initiated and executed the “Advancing the Vision” Symposia I, II and III in Silicon Valley based on Corning’s “A Day Made of Glass” video
  - 100s attendees (CEOs, CTOs, VPs and Directors from more than 100 companies).
  - Formed a consortium to advance the vision of the Connected World.

**December 2005 - June 2007**

**AVAGO TECHNOLOGIES**

*Vice President and Chief Technology Officer, San Jose, CA*

- Director of the US Advanced R&D Center; the growth engine of the company.
- Consultant to top management and major clients (Logitech, HP, Cisco, etc.) on high-level R&D and innovation issues.
- Leader of technical due diligence processes for M&A activities.

- Chief scientist and leader of the R&D groups.
- Director of university relations programs:
  - Invented a novel isolator platform to replace current opto-couple product line.
  - Invented a novel encoder (better than 1-micron resolution) for industrial automation applications.
  - Invented and developed a novel Slide Pad for text entry. Transferred the technology to manufacturing.
  - Invented a new Laser Mouse navigating on glass surfaces.
  - Lead and conducted innovation workshops on CMOS sensors and Gb/s Ethernet transceivers.
  - Generated more than 50 disclosures.

### **December 2003 - December 2005**

#### **AGILENT TECHNOLOGIES**

*Vice President and Director - Photonics & Electronics Research Laboratory, Agilent Labs, Palo Alto, CA*

- Consultant to top management on M&A.
- Leader of photonics, optoelectronics and high-speed mixed-signal IC R&D.
- Thought leader in the areas of innovation, establishing off-shore R&D centers, managing global R&D teams, and building effective R&D organizations:
  - Invented a new optical mouse using lasers (the Laser Mouse) to become the industry standard navigation tool.
  - Invented a Bi-CMOS chip for 10 Gb/s clock and data recovery applications.
  - Invented a new technique for eye detection for applications in automobile drowsy driver detection.
  - Developed novel nano-photonics devices for ultra-sensitive chemical and biological sensors.
  - Invented and developed new techniques for software-defined radios and semiconductor memory test methodologies.
  - Generated more than 100 publications and 300 patents.

### **December 1999 - December 2003**

#### **AGILENT TECHNOLOGIES**

*Laboratory Director - Communications & Optics Research Laboratory, Agilent Labs, Palo Alto, CA*

- Consultant to top management on the R&D process and consultant to major clients on measurements, communications and computer interconnects.
- Excellent track record of inventions:
  - Developed the world's first Optical Mouse using CMOS imagers and light emitting diodes (more than 1.9 billion sold).
  - Invented a micro switch technology using liquid metals as replacements of mechanical switches.
  - Invented and developed a 10 Gb/s optical interconnect multi-chip module.
  - Invented and lead the world in Wide WDM 10 Gb Ethernet technology.
  - Invented and developed a revolutionary optical switching technique for optical networks.
  - Invented and developed a novel micro display technique for wearable personal displays.
  - Invented and developed new integrated circuits for 4 Gb/s computer communications.
  - Invented and developed the world's fastest analog-to-digital converters (20 G samples/s).
  - Invented and demonstrated HP's first blue laser.
  - Won two large (\$50M) DARPA programs for optical interconnects.
  - Transferred (from R&D to manufacturing) an array of technologies for new products (Fiber-Optic Thickness Meter, Capshare handheld scanner, Infinium Oscilloscope, Gigabit Ethernet Transceiver, Lightwave Multi Wavelength Meter, to name a few).
  - Generated more than 300 publications, 200 patents, and 4 books.

### **July 1987 - December 1995**

**HEWLETT-PACKARD COMPANY**

*Manager, Photonics Technology Department, HP Labs, Palo Alto, CA*

- Strategist in the areas of photonics and optoelectronics
- Consultant to top management to draft the vision in the above areas
- Thought leader in technical management and building high-efficiency teams:
  - Pioneered the Optical Interconnects Initiative at HP.
  - Invented and developed low-cost vertical cavity surface emitting lasers (VCSEL's).
  - Invented and developed miniature magneto-optic devices (isolators & circulators) for fiber-optic communications.
  - Invented and developed integrated acousto-optic filters for tunable lasers.
  - Invented and developed a novel technique to accurately measure wavelength of light.
  - Invented and developed a revolutionary technique to use phosphor for higher resolution imaging.
  - Transferred (from R&D to manufacturing) many photonics technologies for T&M products (Lightwave Signal Analyzers, Lightwave Components Analyzers, Tunable Optical Sources, Optical Time Domain Reflectometers, Optical Transceivers).
  - Generated more than 300 publications, 150 patents, and 5 books.

**July 1983 - July 1987**

**HEWLETT-PACKARD COMPANY**

*Manager - Sources & Signal Processing Group, HP Labs, Palo Alto, CA*

- Manager of an engineering group:
  - Invented the straight edge magnetostatic wave resonator.
  - Invented and developed the SAW brick-wall filter.
  - Transferred technologies for several new products (Electronic Spectrum Analyzers and Agile Synthesizers).
  - Generated more than 50 publication and 12 patents.

**December 1978 - July 1983**

**HEWLETT-PACKARD COMPANY**

*Member of Technical Staff/Group Leader, HP Labs, Palo Alto, CA*

- Design engineer for surface acoustic wave, magnetic bubble and magnetostatic wave devices:
  - Invented and developed a low-loss SAW filter.
  - SAW filter was key component in HP's 856X Series of Microwave Spectrum Analyzers.
  - Produced world-record results for MSW resonators and filters.
  - Generated 7 US patents.

## EDUCATION

<b>McMaster University, Canada</b> Honorary Doctor of Science, <i>Honoris Causa</i>	D.Sc.	2018
<b>Stanford University, Stanford, CA:</b> Graduate School of Business. Stanford Executive Program.	S.E.P.	1999
<b>McMaster University, Canada:</b> Department of Electrical Engineering, GPA: 4.0 - Distinction in the Comprehensive Exam. NRC Fellowship.	Ph.D. (E.E.)	1978
<b>McMaster University, Canada:</b> Department of Electrical Engineering. GPA: 4.0 - NRC Fellowship.	M.Sc. (E.E.)	1975

**Ain Shams University, Egypt:** Department of Mathematics. B.Sc. (Math.) 1973  
 GPA: 4.0 - Top student in the University in 1973 - Full University Scholarship.

**Cairo University, Egypt:** Department of Electrical Engineering. B.Sc. (E.E.) 1971  
 GPA: 3.8 - Full University Scholarship.

## PROFESSIONAL AFFILIATIONS

### CURRENT:

- Member, US national Academy of Engineering.
- Fellow, Canadian Academy of Engineering, CAE.
- Life Fellow, IEEE.
- Member, Visiting Committee on Advanced Technologies (VCAT), NIST.
- Member, Dean Technical Advisory Board, School of Engineering, University of California, San Diego.
- Member, Technical Advisory Board, School of Engineering, University of Southern California.
- Member, Technical Advisory Board, School of Engineering, University of California, Santa Barbara.
- Founding Member, Advisory Board, Stanford Photonics Research Center (SPRC).
- Co-Chair, Dean Engineering Advisory Board, School of Engineering, Santa Clara University, California.
- Member, Dean Industrial Advisory Board, McMaster University, Ontario, Canada.

### PAST:

- Board Member, Versalume.
- Chairman of the Board, Optoelectronics Industry Development Association (OIDA).
- Member, Committee on Harnessing the Light for 21<sup>st</sup> Century, National Academies, 2011.
- Member, Strategic Advisory Board, NSF's Center for Material and Device Research for Information Technologies, University of Washington.
- Member, Industrial Advisory Board, Center for Nano Structures and Photonics Technologies (CONSRT), UC Berkeley.
- Member, Advisory Board, Japan Optoelectronic Program (JOP).
- Member, Board of Advisors, Electrical and Computer Engineering Department, University of California, Davis.
- Member, Advisory Board, Multidisciplinary Optical Switching Technology (MOST) Center. University of California, Santa Barbara.
- Member, Advisory Board, Heterogeneous Optoelectronics Technology Center (HOTC), University of California, Santa Barbara.
- Member, Industrial Advisory Board, Center of Photonics Research at the Scuola Superiore Sant'Anna, Pisa, Italy.
- Member, NRC Review Panel, NIST's Optoelectronics Laboratory.
- Member, IEEE Laser and Electro Optic Society (LEOS) Emerging Technical Opportunities Committee.
- Member, Technical Program Committee, Conference on Lasers and Electro Optics (CLEO).
- General Chair of the Integrated Optoelectronics Symposium, Photonics West, 1999
- Taught seven short courses on semiconductor devices and applications, Swedish Royal Institute of Technology, Graduate School of Physics, Stockholm, Sweden, February 1999.

## PUBLICATIONS/PATENTS

### Invited Talks, Publications and Interviews:

1. W. Ishak, "Corning Innovative Materials," Invited, EPIC World Photonic Technology Summit, Brussels, August 2018.
2. W. Ishak, "Corning Material Technologies - Improving the Connected World," Invited, 4<sup>th</sup> Annual World Congress on Smart Materials, Osaka, Japan, March 2018.
3. W. Ishak, "A Vision for the Connected World," Invited, UCSD 5G Forum, May 2017.
4. W. Ishak, "Glass Technologies for Semiconductor Applications," Keynote, IEEE CPMT Symposium, Japan, November, 2015. [http://www.ieee-csj.org/plenary\\_invited\\_ICSJ2015.html](http://www.ieee-csj.org/plenary_invited_ICSJ2015.html)
5. W. Ishak, "Bending Razor-Thin Glass to Tech's Future Needs," Los Angeles Times Interview, November 2015. <http://www.latimes.com/business/technology/la-fi-cutting-edge-glass-20151025-story.html>
6. W. Ishak, "Light is Key to Good Life," The Year of Light Symposium, University of California, Santa Barbara, October 2015. <http://ips.ece.ucsb.edu/events/ucsb-year-of-light-symposium-2015>
7. W. Ishak, "Innovation and Innovators," Distinguished Speakers Series, Technology Management Program, University of California, Santa Barbara, February 2015. <http://www.uctv.tv/shows/Waguih-Ishak-Fortune-500-Intrapreneur-On-Nurturing-A-Culture-Of-Innovation-28964>
8. W. Ishak, "Spotting and Fostering Innovators," TEDx Talk, 2013. <http://up-grade.me/frame/videoplayer.htm?onlineId=25i1190345>
9. W. Ishak, "The Connected World," InnoAsia 2013, Hong Kong, December 2013. <https://www.youtube.com/watch?v=jq08SqlSZaE>
10. W. Ishak, Panel on "Innovations in Solid State Lighting," University of California, Santa Barbara, May 2013. <http://iee.ucsb.edu/summit2013/lighting>
11. W. Ishak, "Ultra-slim, Flexible Glass - Enabling Devices and Design Evolution," Printed Electronics USA, December 2012.
12. W. Ishak, "A Day Made of Glass - A View of a Vision to Come," INMA Audience Summit, Las Vegas, October 2011.
13. W. Ishak, "Advancing the Vision of the Connected World," Wave 2011, Lake Louise, Alberta, October 2011.
14. W. Ishak, "Applications of Optoelectronics in Life Sciences, Communications and Computation," Optoelectronics Workshop, 217<sup>th</sup> ECS Meeting, Vancouver, Canada, April 2010.
15. W. Ishak, "The Impact of Nanotechnology on Health Care, Communications, and Entertainment," ChemShow, Nano and Green Technologies 2009 Symposium and Show, New York, November 2009.
16. W. Ishak, "Nanotechnology for the 21<sup>st</sup> Century," NanoBusiness Alliance, Chicago, Illinois, September 2009.
17. W. Ishak, "The Impact of Nanotechnology on Health Care, Communications, and Entertainment," Nano-Giga Conference, McMaster University, Hamilton, Ontario, Canada, August 2009.
18. W. Ishak, "The Nano-Bio-Info-Cogno Revolution," International Nano-Optoelectronics Workshop (iNOW-2008), Tokyo, Japan, August 2008.
19. W. Ishak, "Innovations in Optoelectronics Are Driving Innovations in High Speed Electronics - or is it the other way around?" International Electronics Forum (IEF) 2008, Dubai, May 2008.
20. W. Ishak, "Innovations in Electronics, Optics, MEMS and Biology for Communications, Computation and Life Sciences," Alexander Graham Bell Distinguished Speaker, McMaster University, Canada, March 2008.
21. W. Ishak, "Vertical Cavity Surface Emitting Lasers and Their Applications to Computer Interconnects and Consumer Electronics," Workshop for the 30<sup>th</sup> Anniversary for the Invention of the VCSEL, Tokyo, Japan, December 2007.
22. W. Ishak, "The Digital Society of the 21st Century - How Electronics, Photonics, MEMS, and Biology Will Impact Consumers," Stanford University's Photonics Research Center, SPRC Visionary Innovation Seminar Series, Inaugural Presentation, October 2006.

23. W. Ishak, "The Digital Society of the 21<sup>st</sup> Century," Future Horizon Conference, Budapest, Hungary, May 2006.
24. W. Ishak, "Applications of Photonics, Electronics and MEMS in Consumer Electronics," IEE/Fabless Semiconductor Association International Semiconductor Executive Forum, London, UK, May 2005.
25. W. Ishak, "The Future of Light - The Pervasiveness of Photonics in Communications, Sensors, Measurements, and Life Sciences," Boston University's Future of Light Seminar, November 2004.
26. W. Ishak, "Photonics & Optoelectronics for Communications, Measurements and Life Sciences'" OpNeTec Conference, Pisa, Italy, October 2004.
27. W. Ishak, "Mega Trends in Photonics and Electronics," Photonics North, Ottawa, Canada, September 2004.
28. W. Ishak, "Micro Photonic Devices for Low-Cost Optoelectronics," Invited Paper, ECTC Conference, May 2003.
29. W. Ishak, "Micro Photonic Integrated Circuits," Plenary Talk, First International Conference on Optical Communications and Networks, Singapore, November 2002.
30. W. Ishak, "Pervasive Photonics; Applying Photons to Communications, Sensors and Solid-State Lighting," Keynote Speech, Opto Ireland, Galway, Ireland, September 2002.
31. W. Ishak & L. Desjardin, "The New Economy of Light," Invited Paper, Opticon 2002, San Jose, Ca, August 2002.
32. W. Ishak, "The New Economy of Light: Taking a Byte out of the Price per Bit in Communication Links," The Australian Conference on Fiber Optic Technology (ACOFT), Sidney, Australia, July 2002.
33. W. Ishak, "Applications of Photonics in Communications, Measurements and Interconnections," Ireland Development Association and Science Foundation Ireland Special Meeting, April 2002.
34. W. Ishak, "High Speed Optoelectronics," SPIE International Symposium on Photonics Applications, Singapore, November 2001.
35. W. Ishak, "The Tera Era and Its Implications on Communications," Distinguished Seminar Series, McMaster University, Hamilton, Ontario, Canada, September 2001.
36. W. Ishak, "High Speed Optoelectronics & Fiber Optics," SPIE International Symposium on the Convergence of Information Technology and Communications (ITCOM), Denver, CO, August 2001
37. W. Ishak, "Photonics & High Speed Optoelectronics," Plenary Talk at Agilent's Technology Day to the German Industry and Academia, Boeblingen, Germany, June 2001.
38. W. Ishak, Participant (with Lucent, Corning & Nortel) at the OFC Roundtable Discussion on All Optical Networks, Optical Fiber Conference (OFC), March 2001.
39. W. Ishak, "The Bandwidth Tidal Wave", Boston University Center for Photonics Technology, October 2000.
40. W. Ishak, L. Blake, D. Bastein, J. Fouquet & B. Lemoff, "The Optical Network Revolution," Networks 2000, Toronto, Canada, September 2000.
41. W. Ishak, "The Tera Era," WDM - Systems and Applications, NIST Workshop, November 1999.
42. W. Ishak, "Multi Gb/s Optical Interconnects," International Conference on Optics (ICO-XVIII), San Francisco, August 1999.
43. W. Ishak, "Creating R&D Technology Portfolios," International Research Institute Meeting, South Carolina, 1998.
44. W. Ishak, Alastair Glass, Cliff Higerson, Scott Kriens, "Thousand Points of Light: On the Road to the All-Optical network," Panelists, Infrastructure of the Internet, Network Outlook Conference, 1998.
45. W. Ishak, "The Tera Era," Hewlett-Packard Journal, December 1997.
46. W. Ishak, K. Giboney, "Optical Interconnect Technology Meets Standards," Laser Focus World, vol.33, no.12, pp. 15-17, 1997.
47. W. Ishak, "Optoelectronics for the Information Age - the Tera Era," Second OECC Conference, Seol, Korea, 1997.



48. W. Ishak, "Vertical Cavity Surface Emitting Lasers for the Tera Era," 55<sup>th</sup> Annual Device Research Conference, June 1997.
49. W. Ishak, "High Speed Parallel Optical Interconnects - Preparing for the Tera Era," High Speed Interconnects Workshop, Santa Fe, NM, 1997.
50. W. Ishak, "High-Speed Optical Interconnects - A Review," Japan Science and Tech Corporation (JST) Meeting, Tokyo, 1996.
51. W. Ishak, "InP-based Optoelectronic Components for Measurements, Communications, and Computers," Eighth International Conference on Indium Phosphide and Related Materials (IPRM), Germany, 1996.
52. W. Ishak, Lewis Aronson, Brian Lemoff, David Dolfi, "Wavelength Division Multiplexed Local Area Networks Using Low-Cost Optoelectronics," Eighth Tyrrhenian International Workshop on Digital Communications, Lerici, Italy, September 1996.
53. W. Ishak, "Photonics Applications for Measurements, Communications and Computers," IEEE Lasers and Electro-Optics Society Meeting, San Francisco, 1995.
54. W. Ishak, "Lightwave Technology," Invited Guest at Sonoma State University's Series on "What Physicists Do," November 1993.
55. W. Ishak, K. Carey, S. Newton, W. Trutna, "Photonic Technology for Lightwave Communications Test Applications," Hewlett-Packard Journal, vol.44, no.1, pp.6-10, 1993.
56. W. Ishak, "Magnetostatic Wave Technology: A Review," Proceedings of the IEEE, vol.76, no.2, pp.171-187, 1988.
57. W. Ishak, "Microwave Signal Processing Using Magnetostatic Wave Devices," Proceedings of IEEE Ultrasonics Symposium, Dallas, TX, vol. 1, pp. 152-163., 1984.
58. W. Ishak, E. Karrer, R. Shreve, "Surface Acoustic Wave Delay Lines and Transversal Filters," Hewlett-Packard Journal, vol.32, no.12, pp. 3-8, 1981.

#### **Contributed Publications (Journal and Conference Publications):**

1. K. Hahn, J. Straznicky, M. Tan, S. Wang, R. Kaneshiro, D. Dolfi, W. Ishak, R. Wilson, S. Joiner, E. Mueller, A. Plotts, D. Murray, B. Sano, Y. Koh, A. Levi, "POLO: Parallel Optical Links for Workstation Clusters and Switching Systems," Conference on Optical Fiber Communication, San Diego, Ca., p. 112, 1995.
2. W. Ishak, K. Hahn, B. Booth, C. Mueller, A. Levi, R. Craig, "Optical Interconnects: The POLO Approach," Proceedings of the SPIE, vol. 2400, pp. 214-221, 1995.
3. H. Tanbakushi, D. Nicholson, B. Kunz, W. Ishak, "Magnetically Tunable Oscillators and Filters," IEEE Transactions on Magnetics, vol.25, no.5, pp. 3248-3253, 1989.
4. W. Ishak, K. Chang, B. Kunz, G. Miccoli, "Tunable Microwave Resonators and Oscillators Using Magnetostatic Waves," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, vol. 35, no. 3, pp. 396-405, 1988.
5. W. Ishak, "Magnetostatic Wave Technology - A Review," IEEE, Proceedings, vol. 76, p. 171-187, Feb. 1988.
6. W. Ishak, C. Flory, B. Auld, "Acoustic Modes in Lithium Tetraborate," Proceedings of the IEEE Ultrasonics Symposium, vol. 1, pp. 241-245, 1987.
7. E. Reese, W. Ishak, "Wideband Discriminators Using Tunable MSW Delay-Lines," IEEE Transaction on Ultrasonics, Ferroelectrics, and Frequency Control, vol. 33, no. 1, p. 110, 1986.
8. W. Ishak, K. Chang, "Phase Noise Characteristics of MSW Delay Line," IEEE Transaction on Ultrasonics, Ferroelectrics, and Frequency Control, vol. 33, no. 1, p. 112, 1986.
9. B. Kunz, K. Chang, W. Ishak, "MSW-SER Based Tunable Oscillators," Proceedings of IEEE Ultrasonics Symposium, Williamsburg, VA., vol. 1, pp. 187-190, 1986.
10. W. Ishak, K. Chang, "Tunable Microwave Resonators Using Magnetostatic Waves in YIG Films," IEEE Transactions on Microwave Theory and Techniques, vol. MTT-34, no.12, pp.1383-1393, 1986.
11. K. Chang, W. Ishak, "Magnetostatic Forward Volume Wave Straight Edge Resonators," Proceedings of IEEE International Microwave Symposium, Baltimore, MD., pp. 473-475, 1986.

12. K. Chang, W. Ishak, "Magnetostatic Forward Volume Wave Straight Edge Resonators," *Microwave Journal*, vol. 29, no. 5, p. 94, 1986.
13. E. Reese, W. Ishak, "Automatic Phase Noise Measurements Using MSW Delay Line Based Discriminators," *Proceedings of IEEE Ultrasonics Symposium*, San Francisco, CA., pp. 169-173, 1985.
14. K. Chang, W. Ishak, B. Kunz, "Phase Noise Characteristics of MSW Devices," *Proceedings of IEEE Ultrasonics Symposium*, San Francisco, CA., pp. 163-168, 1985.
15. W. Ishak, E. Reese, E. Huijjer, "Magnetostatic Wave Devices for UHF Band Applications," *Journal on Circuits, Systems, and Signal Processing* vol.4, no.1-2, pp. 285-300, 1985.
16. K. Chang, W. Ishak, "Magnetostatic Surface Wave Straight Edge Resonators," *Journal on Circuits, Systems, and Signal Processing* vol.4, no.1-2, pp. 201-209, 1985.
17. W. Ishak, K. Chang, "Magnetostatic Wave Devices for Microwave Signal Processing," *Hewlett-Packard Journal*, vol.36, no.2, pp.10-20, 1985.
18. K. Chang, W. Ishak, "The Effect of Width Modes on the Performance of MSSW Resonators," *Proceedings of IEEE Ultrasonics Symposium*, Dallas, TX, vol. 1, pp. , 1984.
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