

# JOSEPH E. FORD

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## ACADEMIC DEGREES

<u>Ph.D. Elec. Eng. / Appl. Physics</u>	University of California San Diego	January 1992
<u>M.Sc. Optical Engineering</u>	University of Rochester	May 1986
<u>M.Sc. Physics</u>	University of British Columbia	September 1985
<u>B.Sc. Physics</u>	University of California Los Angeles	June 1983

## RESEARCH EXPERIENCE

12/02 to Date Professor, UCSD Department of Electrical & Computer Engineering

Leading the Photonics Systems Integration Lab ([www.psilab.ucsd.edu](http://www.psilab.ucsd.edu)), with current research funding from the NSF, DARPA, and industry.

- Application-specific computational imagers, e.g. ultra-thin telephoto lenses, compressive imaging, gigapixel real time video, and compact wide-angle cameras.
- Optical communication systems using free-space and fiber optics, e.g. fast MEMS switching for datacenters, 1000 channel wavelength multiplexing, retromodulators.
- Other topics including waveguide based solar photovoltaic concentrators, computer-controlled LED lighting, switchable 1x/3x contact lens telescope, etc.

1/02 to 11/02 Founder, Modern Optics

Developed IP on a tunable passband width and center wavelength filter. Transferred component to telecom equipment manufacturer Onetta / Bookham for development.

3/00 to 1/02 Project Director / Chief Scientist, Optical Micro-Machines

OMM was the first manufacturer of Telcordia-qualified telecom MEMS switches. Overall technical lead of a 90+ person effort to develop a 288x288 MEMS crossconnect. Remained on OMM's Technical Advisory Board until OMM's closure in 2003.

3/94 to 3/00 MTS, AT&T / Lucent Bell Laboratories Advanced Photonics Research Department

Led research to develop the first micromechanical (MEMS) based components for multi-wavelength transmission systems. Designed devices, optics and optomechanics, built and tested prototypes, as well as drive electronics and system interface, for:

- Spectral equalizer for automatic gain and channel power control.
- Fast variable attenuator for transient power level stabilization.
- Dispersion and gain-slope compensators for 10 to 40 Gb/s transmission.
- Wavelength add/drop switch for dynamic bandwidth allocation.

Co-directed a switched data network project using opto-electronic VLSI 850 nm MWQ modulators and a central femtosecond laser source. Responsible for all optics and opto-mechanics, and the construction of a network system demo.

- 6/93 to 3/94 Research Scientist, Call/Recall Corporation  
Performed first multiplexed image storage by two-photon recording in doped-polymer media for a start-up company working on 3-D data storage. Built out lab and office space, led initial experiments, and co-authored proposals.
- 1/92 to 6/93 Assistant Research Scientist, UCSD Electrical & Computer Engineering Dept.  
Conducted research and directed students on two government-funded projects: a two-photon 3-D optical memory, and a circuit-switched optical interconnection network using novel polarization-selective digital holograms etched into birefringent substrates.
- 9/86 to 12/91 Research Assistant, UCSD Electrical & Computer Engineering Department  
Demonstrated a 1024x1024 free-space switching network for optoelectronic chip-to-chip communication. Ph.D. dissertation: "*Reconfigurable array interconnection by photorefractive volume holography.*"
- 9/83 to 9/85 Research Assistant, University of British Columbia Physics Department  
Constructed XeCl excimer laser using a novel fast capacitor discharge circuit. Measured discharge electron pump dynamics via CO<sub>2</sub> laser interferometry. M.Sc. thesis: "*Investigations into the XeCl excimer laser.*"

## **MILESTONES**

- 1997 Live public demonstration of first MEMS wavelength add/drop switch  
(Lucent Bell Labs Technology Showcase, Murray Hill, NJ)
- 2000 Live public demonstration of first MEMS dynamic spectral equalizer  
(Lucent/Agere Technology Exhibit, Optical Fiber Communications Conference)
- 2005/8 Live demonstrations of 8-fold and 4-fold imager prototypes to DARPA  
Director in Washington DC.
- 2009 Fellow of the Optical Society of America

## **PROFESSIONAL ACTIVITIES**

Collaborative Research Program Lead, DARPA SCENICC 3-D Optics (2011-2015)  
Conference Co-Chair, 2010 and 2011 OSA Congress on Optics in Solar Power  
Co-Director of the California Solar Energy Collaborative (2009-2010)  
Conference Co-Chair, 2008 Optical Fiber Communications Conference  
Topical Issue Co-Editor, Feb. 2007 IEEE Journal of Lightwave Technology  
Program Co-Chair, 2006 Optical Fiber Communications Conference,  
Topical Issue Co-Editor, Feb. 2002 IEEE J. Selected Topics in Quantum Electronics  
Conference Co-Chair: First IEEE/LEOS International Conference on Optical MEMS.  
Kawai, Hawaii (Sept. 2000)

Program Committees, OSA Conference on Computational Optical Sensing and Imaging 2014-2105, IEEE International Conference on Computational Photography 2012-2015, IEEE Optical MEMS and Nanophotonics, 2011, OSA Frontiers in Optics, 2006 and 2007, 2002-2004 OSA / IEEE Optical Fiber Communications Conference, 2003 SPIE Conference on Device and Process Technologies for Microelectronics, MEMS, and Photonics, SPIE Asian-Pacific Optical and Wireless Communications Conference, Optical Switching and Integration II, 2003 OSA Topical Meeting on Optics in Computing, 2003 IEEE Design, Test and Integration of MEMS/MOEMS (DTIP), 2002 OSA / IEEE Integrated Photonics Research Conference, 2002 IEEE Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS, IEEE International Conference on Optical MEMS, SPIE 2001 International Symposium on Microelectronics and Micro-Electro-Mechanical Systems, 2001 IEEE Symposium on Design, Test, Integration and Packaging of MEMS / MOEMS, IEEE CPMT & LEOS Workshop on Fiber-Optics, 1999 Optoelectronics, Photonics Assembly, Packaging & Manufacturing Technology, 1998 IEEE/LEOS Summer Topical Meeting on Optical MEMS, 1997 OSA Topical Meeting on Spatial Light Modulators, 1997 IEEE/LEOS Workshop on Interconnections within High-Speed Digital Systems.

Reviewer for peer-reviewed journal publications including ACM Transactions on Sensors Networks, Applied Optics, Applied Physics Letters, Energy Express, IEEE Communications Society Magazine, IEEE Journal of Optical Networking, Journal of Lightwave Communications, IEEE Journal of MEMS, IEEE Sensors Magazine, Journal of Electronic Materials, Journal of the Optical Society of America, Journal of Progress in Photovoltaics, Nature Photonics, Optical Engineering, Optics Express, Optics Letters, Photonics Technology Letters, Proceedings of the National Academy of Sciences.

Member of the Optical Society of America and IEEE Lasers & Electro-Optics Society

## **PUBLIC PRESENTATIONS AND ARTICLES**

Publications: Author or co-author of more than 200 refereed journal articles and conference presentations, invited talks and panel discussions.

Patents: Author or co-author of 48 issued U.S. Patents on computing, communications, data storage and imaging technology.

## REFEREED JOURNAL PUBLICATIONS

1. J. E. Ford, J. Meyer, and H. Houtman, "Measurement of electrical characteristics and electron density in a fast discharge pumped XeCl excimer laser," *Applied Physics Letters* 48, 1639-1641, 1986.
2. J. E. Ford, Y. Fainman, and S. H. Lee, "Time integrating interferometry using photorefractive fanout," *Optics Letters* 13, 856-858, 1988.
3. J. E. Ford, Y. Fainman, and S. H. Lee, "Enhanced photorefractive performance from 45°-cut BaTiO<sub>3</sub>," *Applied Optics* 28, 4808-4815, 1989.
4. J. E. Ford, Y. Fainman, and S. H. Lee, "Array interconnection by phase coded optical correlation," *Optics Letters* 15, 1088-1090, 1990.
5. J. Ma, J. E. Ford, Y. Taketomi, and S. H. Lee, "Moving grating for enhanced holographic recording in SBN:60," *Optics Letters* 16, 270-272, 1991.
6. R. Paturi, D. T. Lu, J. E. Ford, S. C. Esener, and S. H. Lee, "Parallel algorithms based on expander graphs for optical computing," *Applied Optics* 30, 917-927, 1991.
7. J. Ma, Y. Taketomi, Y. Fainman, J. E. Ford, S. H. Lee, and Ken'ichi Chino, "Moving grating and dc external field in photorefractive GaP at 633 nm," *Optics Letters* 16, 1080-1082, 1991.
8. Y. Taketomi, J. E. Ford, H. Sasaki, J. Ma, Y. Fainman, and S. H. Lee, "Incremental recording for photorefractive hologram multiplexing," *Optics Letters* 16, 1774-1776, 1991.
9. H. Sasaki, Y. Fainman, J. E. Ford, Y. Taketomi, and S. H. Lee, "Dynamic photorefractive optical memory," *Optics Letters* 16, 1874-1876, 1991.
10. H. Houtman, A. Cheuck, A. Y. Elezzabi, J. E. Ford, M. Laberge, W. Leise, J. Meyer, G. C. Stuart, and Y. Zhu, "High speed circuits for TE discharge lasers and high-voltage applications," *Review of Scientific Instruments* 64(4), 839-853, 1993.
11. J. E. Ford, Y. Taketomi, D. Bize, R. R. Neurgaonkar, Y. Fainman, and S. H. Lee, "Multiplex holography in SBN:60 with applied field," *Journal of the Optical Society of America A* 9, 1183-1192, 1992.
12. J. E. Ford, F. Xu, K. Urquhart, and Y. Fainman, "Polarization selective computer generated holograms," *Optics Letters* 18, 456-458, 1992.
13. H. Takahashi, D. Zaleta, J. Ma, J. Ford, Y. Fainman and S. Lee, "Packaged optical interconnection system based on photorefractive correlation," *Applied Optics* 33, 2991-2997, 1994.
14. J. E. Ford, Y. Fainman, and S. H. Lee, "Reconfigurable array interconnection by photorefractive correlation," *Applied Optics* 33, 6363-6377, 1994.
15. J. Ma, B. Catanzaro, J. Ford, Y. Fainman, and S. Lee, "Photorefractive holographic lenses and applications for dynamic focusing and dynamic image shifting," *Applied Optics* 11(8), 1994.
16. F. Xu, J. Ford, Y. Fainman, "Polarization selective computer generated holograms: Design, fabrication and applications," *Applied Optics* 34, 256-266, 1995.
17. S. Hunter, C. Solomon, S. Esener, J. Ford, A. Dvornikov, P. Rentzepis, "3-dimensional optical image storage by 2-photon recording," *Optical Memory and Neural Networks* 3, 261-290, 1994.
18. R. Piyaket, S. Hunter, J. Ford, and S. Esener, "Programmable ultra-short optical pulse delay using an acousto-optic deflector," *Applied Optics* 34, 1445-1453, 1995.
19. J. E. Ford, F. Xu and Y. Fainman, "Wavelength-selective planar holograms," *Optics Letters* 21, 80-82 1996.
20. A. V. Krishnamoorthy, A. Lentine, K. Goossen, J. Walker, T. Woodward, J. Ford, G. Aplin, L. D'Asaro, S. Hui, B. Tseng, R. Leibenguth, D. Kossives, D. Dahringer, L. Chirovsky and D. Miller, "3-D

- Integration of MQW modulators over active submicron CMOS circuits: 375 Mb/s transimpedance receiver-transmitter circuit,” *IEEE Photonics Technology Letters* 7, 1288-1290, 1996.
21. F. Xu, R-C. Tyan, Y. Fainman and J. E. Ford, “Single-substrate birefringent computer generated holograms” *Optics Letters* 21, 516-518, 1996.
  22. A. V. Krishnamoorthy, J. E. Ford, K. W. Goossen, J. A. Walker, A. L. Lentine, S. P. Hui, B. Tseng, L. M. F. Chirovsky, R. Leibenguth, D. Kossives, D. Dahringer, L. A. D’Asaro, F. E. Kiamilev, G. F. Aplin, R. G. Rozier and D. A. B. Miller, “Photonic page buffer based on GaAs MQW modulators bonded directly over active silicon CMOS circuits,” *Applied Optics* 35, 2439-2456, 1996.
  23. A. V. Krishnamoorthy, F. Xu, J. E. Ford and Y. Fainman, “Polarization-controlled multistage switch based on polarization-selective birefringent computer generated holograms” *Applied Optics* 36(5), 997-1010, 1997.
  24. F. Xu Y. Fainman, J. E. Ford and A. V. Krishnamoorthy, “Optoelectronic-VLSI packaging with polarization-selective computer generated holograms,” *Optics Letters* 22(14), 1095-1097, 1997.
  25. A. V. Krishnamoorthy, R. G. Rozier, J. E. Ford and F. E. Kiamilev, “CMOS static RAM chip with high-speed optical read and write,” *IEEE Photonics Technology Letters* 9(11), pp. 1517-1519, November 1997.
  26. J. E. Ford and D. J. DiGiovanni, “1xN fiber bundle scanning switch,” *IEEE Photonics Technology Letters* 10(7), 967-969, July 1998.
  27. J. E. Ford, J. A. Walker, D. S. Greywall and K. W. Goossen, “Micromechanical fiber-optic attenuator with 3 microsecond response,” *IEEE Journal of Lightwave Technology* 16(9), 1663-1670, September 1998.
  28. J. E. Ford and J. A. Walker, “Dynamic spectral power equalization using micro-opto-mechanics,” *IEEE Photonics Technology Letters* 10(10), 1440-1442, October 1998
  29. J. E. Ford, V. A. Aksyuk, D. J. Bishop and J. A. Walker, “Wavelength add/drop switching using tilting micromirrors,” *IEEE Journal of Lightwave Technology* 17(5), 904-911, May 1999.
  30. A. V. Krishnamoorthy, J. E. Ford, F. E. Kiamilev, R. Rozier, K. Goossen, B. Tseng, J. Walker, J. Cunningham, W. Y. Jan and M. C. Nuss, “The AMOEBa network: an optoelectronic switch for multiprocessor networking using dense-WDM,” *IEEE Journal of Selected Topics in Quantum Electronics* 5(2), 261-275, March 1999.
  31. C. K. Madsen, J. A. Walker, J. E. Ford. K. W. Goossen, T. N. Nielson and G. Lenz, “A tunable dispersion compensating MEMS all-pass filter,” *IEEE Photonics Technology Letters* 12(6), pp. 651-653, June 2000.
  32. K. W. Goossen, J. A. Walker, D. T. Neilson, J. E. Ford and W. H. Knox, “Micromechanical gain slope compensator for spectrally linear optical power equalization,” *IEEE Photonics Technology Letters* 12(7), pp. 831-833, July 2000.
  33. J. E. Ford, K. W. Goossen, J. A. Walker, D. T. Neilson, D. M. Tennant, S. Y. Park and J. W. Sulhoff, “Interference Based Micromechanical Spectral Equalizers” *IEEE Journal of Selected Topics in Quantum Electronics*, 10(3), pp. 579-587, May-June 2004.
  34. J. A. Dobrowolski, J. E. Ford, B. T. Sullivan, L. Lu, and N. R. Osborne, “Conducting antireflection coatings with low polarization dependent loss for telecommunication applications,” *Optics Express* 12(25), pp. 6258-6269, 2004.
  35. Q. Lin, R. Jiang, C. F. Marki, C. J. McKinstrie, R. Jopson, J. Ford, G. P. Agraway and S. Radic, “40 Gb/s Optical Switching and Wavelength Multicasting in a Two-Pump Parametric Device,” *IEEE Photonics Technology Letters* 17, pp. 2376-2378, Nov. 2005 (NEW)

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