

THOMAS BIFANO

Director, Boston University Photonics Center
Professor Mechanical Engineering Department
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Education

Duke University Mechanical Engineering & Materials Science, BS, 1980
Duke University Mechanical Engineering & Materials Science, MS, 1983
North Carolina State University, Mechanical Engineering, Ph.D. 1988
Dissertation: "Ductile Regime Grinding of Brittle Materials," Thomas A. Dow, advisor

Appointments

Director, Boston University Photonics Center, 2006-
Professor and Chair, Manufacturing Engineering Dept., Boston University, 1999- 2006
Professor, Mechanical Engineering Dept., Boston University, 1999-
Chief Technical Officer, Boston Micromachines Corporation, Watertown, MA, 1999-
President, Prism Corporation, Boston, MA, 1995-2000
Associate Professor, Aerospace/Mechanical Eng., Boston University, 1994-1999
Assistant Professor, Aerospace/Mechanical Eng., Boston University; 1988-1994

Research

Microelectromechanical Systems (MEMS); Optomechanical devices; Deformable mirrors; Manufacturing of optical components; Smart structures; Fluidic microsystems; Micromachining; Bioarray synthesis; Networked control systems; Adaptive optics

Funded Research

1/88 – 12/10: PI (not as Ctr Dir): \$6.9M, PI (as Ctr Dir): \$29.5M, Co-PI: \$9.2M

Patents, Awards, Honors

2011 U.S. Patent (#7,929,195) MEMS Based Retroreflector
2010 R&D 100 Award: (MEMS)-based Adaptive-Optics Optical Coherence Tomography
2009 Bepi Colombo Prize, for achievements in research, innovation, and tech. transfer
2007 R&D 100 Award: Adaptive Optics Scanning Laser Ophthalmoscope (MAOSLO)
2005 U.S. Patent (#6,929,721) Ion modification of residual stress gradients in thin films
2004 U.S. Patent (#6,705,345) Micro valve arrays for fluid flow control
2003 R&D 100 Award: MEMS-based adaptive optics phoropter (MAOP)
2003 U.S. Patent (#6,529,311) MEMS-based spatial-light modulator
1998 U.S. Patent (#5,783,371) Process for manufacturing optical data storage disk
1997 U.S. Patent (#5,503,963) A new method for manufacturing optical disc stampers

Professional Service

Member, Army Science Board, 2011
Board of Advisors, Schott AG, 2009-
Technical Session Chair, ASPE, ASME, SPIE, SME, OSA
Board of Directors, Amer. Soc. Precision Eng., 1994-1996
Chairman 1994, 1995 Annual and Topical ASPE Conferences
Associate Editor, Journal of Micro/Nanolithography, MEMS, and MOEMS 2006-
Associate Editor, Int'l J. Mfg. Science and Production 2002-2004
Associate Editor, SME J. Manufacturing Processes 2000-2004

National Academy of Science Review Panel: Wright Awards

University Service

Chair, University Research Council, 2008-
Chair, Dean Search Committee, College of Engineering, 2005-06
Chair, Provost's Faculty Advisory Committee on Photonics, 2005-06
Chair, Faculty Council, Appt., Tenure, and Promotion Policy Comm., 2003-04
Director, Precision Engineering Research Laboratory (BU-PERL), 1990-
Presidential University Graduate Fellowship Committee 1994-1999
Director, Aerospace/Mechanical Eng. graduate programs, 1988-1991
Faculty advisor to engineering residence hall (Clafin 11), 1990-1995
Faculty advisor to "In Achord," BU a cappella singing group, 1993-1998

Activity Highlights

Director, **Boston University Photonics Center**. Dr. Bifano directs this core facility and academic center of excellence comprised of thirty-five faculty members eighty graduate students, and ten staff members from seven academic departments. He leads BUPC programs for education, scholarly research and development of advanced photonic device prototypes for commercial and military applications. He manages a state-of-the-art facility that includes more than a dozen special-purpose and shared research laboratories and a large business incubator.

Co-founder of the Boston University **Freshman Research Opportunity Program (FROP)**, a College of Engineering program that sponsors students in 10 week research projects in the summer before their matriculation. The program ran for more than a decade, supporting more than 200 summer interns.

Co-founder and Chief Technical Officer, **Boston Micromachines Corporation**, a University spin-off company that was formed to commercialize micromachined deformable mirror technology initially developed through an NSF Small Grant for Exploratory Research (and subsequently funded by DARPA and NASA). This company, now in its 6th year of operation, has nine employees. Its synergistic activities include translation of academic intellectual property to commercial products, support of coop students, and employment of three Boston University engineering graduates.

Collaborators & Other Affiliations

Chief Technical Officer, **Boston Micromachines Corporation**

Collaborators or Co-authors include:

Stephen Burns, University of Indiana
Alex Cable, Thorlabs Corporation
B. M. Levine, NASA Jet Propulsion Laboratory
Charles Lin, Massachusetts General Hospital
Rob Webb, Schepens Eye Research Institute
Scot Olivier, Lawrence Livermore National Laboratory
Joel Kubby, University of California at Santa Cruz

Graduate Advisors and Postdoctoral Sponsors.

Thomas Dow, NC State University
Ron Scattergood, NC State University

Advising

30 graduate theses supervised, 2 postdoctoral researchers sponsored

Selected Recent Invited Presentations

- 2011 Plenary, Int'l. Conference on Optical MEMS & Nanophotonics, Istanbul, Turkey
- 2010 Plenary, MOEMS-MEMS, Shaping Light SPIE Photonics West, San Francisco, CA
- 2009 AO4ELT, Paris France
- 2008 IEEE/LEOS The Future of Light: Research Careers in Photonics
- 2007 OSA Adaptive Optics, Analysis and Methods
- 2006 SPIE MEMS/MOEMS Components and Their Applications III
- 2006 SPIE Target-in-the-Loop: Atmospheric Tracking, Imaging, and Compensation II

Journal Publications

- Goldberg BB, Yurt A, Lu Y, Ramsay E, Koklu FH, Mertz J, Bifano TG, Ünlü MS, “Chromatic and spherical aberration correction for silicon aplanatic solid immersion lens for fault isolation and photon emission microscopy of integrated circuits,” **Microelectronic Reliability**, [51], 1637-1639, 2011.
- Bifano T, “Adaptive imaging: MEMS deformable mirrors,” **Nature Photonics**, [5], 21-23, 2011.
- Diouf A, Stewart JB, Cornelissen SA, Bifano TG, “Development of Through-Wafer Interconnects for MEMS Deformable Mirrors,” **International Journal of Optomechatronics**, [4], 237 - 245, 2010.
- Vogel C, Tyler G, Lu Y, Bifano T, Conan R, Blain C, “Modeling and parameter estimation for point-actuated continuous-facesheet deformable mirrors,” **J. Opt. Soc. Am. A**, [27], A56-A63, 2010.
- Diouf A, Legendre AP, Stewart JB, Bifano TG, Lu Y, “Open-loop shape control for continuous microelectromechanical system deformable mirror,” **Appl. Opt.**, [49], G148-G154, 2010.
- Cornelissen, S. A, Bierden, P. A., Bifano, T. G., Lam, C. V., “4096-element continuous face-sheet MEMS deformable mirror for high-contrast imaging,” **Journal of Micro/Nanolithography, MEMS and MOEMS** 8, pp. 031308-031308, 2009
- Diouf, A. Reimann, G. and Bifano, T., ”Fabrication of implantable microshunt using a novel channel sealing technique,” **J. Micro/Nanolith. MEMS MOEMS** [7], pp. 030501-1:3, 2008
- Stewart, J. B., Diouf, A., Zhou, Y. and Bifano, T. G. , "Open-loop control of a MEMS deformable mirror for large-amplitude wavefront control," **J. Opt. Soc. Am. A** [24], pp. 3827-3833, 2007
- Stewart J.B., Bifano T.G., Cornelissen S., Bierden P., Levine B. M., Cook T., “Design and development of a 331-segment tip-tilt-piston mirror array for space-based adaptive optics,” **Sensors and Actuators A- Physical** [138] pp. 230-238, 2007
- Biss, D. P., Sumorok, D., Burns, S. A., Webb, R. H., Zhou, Y., Bifano, T. G., Côté, D., Veilleux, I., Zamiri, P., and Lin, C. P., “In vivo fluorescent imaging of the mouse retina using adaptive optics,” **Opt. Lett.** [32], pp. 659-661, 2007
- Chen, F., Cohen, H.I., Bifano, T.G., Castle, J., Fortin, J., Kapusta, C., Mountain, D.C., Zosuls, A., Hubbard, A.E., “A hydromechanical biomimetic cochlea: Experiments and models,” **J. Acoust. Soc. Am.** [119], pp.394-405, 2006
- Miller, M. H, Perrault, J. A., Parker, G. G., Bettig B. P., and Bifano T. G., “Simple models for piston-type micromirror behavior,” **J. Micromech. Microeng.** [16] pp. 303–313, 2006
- Santiago, LP, Bifano, T. G., “Management of R&D projects under uncertainty: multidimensional approach to managerial flexibility,” **IEEE Trans Eng Mgmt** 52(2):269-80, 2004

- Collier, J., Wroblewski, D., and Bifano, T., "Development of a rapid-response flow-control system using MEMS microvalve arrays," **J. Microelectromechanical Systems**, [13](6), pp. 912-922, 2004
- Webb, R., Albanese, M., Zhou, Y., Bifano, T., and Burns, S., "A stroke amplifier for deformable mirrors," **Applied Optics**, [43]12, pp. 5330-5333, 2004
- Lee, H., Miller, M. H., and Bifano, T. G., "CMOS chip planarization by chemical mechanical polishing for a vertically stacked metal MEMS integration." **J. Micromech. Microeng.**, [14] 1, pp. 108-115, 2004
- Bifano, T. G., Johnson, H. T., Bierden, P. and Mali, R. K., "Elimination of Stress-Induced Curvature in Thin-Film Structures" **J. Microelectromechanical Systems**, [11], pp 592-597, 2002
- Perreault, J. A., Bifano, T. G., Levine, B.M., and Horenstein, M., "Adaptive optic correction using microelectromechanical deformable mirrors," **Optical Engineering** [41]3, pp. 561-566, 2002
- Horenstein, M., Pappas, S., Fishov, A.*, and Bifano, T.G., "Electrostatic Micromirrors for Subaperturing in an Adaptive Optics System," **Journal of Electrostatics**, Vol. 54, pp. 321-332, 2002
- Weyrauch T., Vorontsov M. A., Bifano T. G., Hammer J. A., Cohen M., and Cauwenberghs G., "Microscale adaptive optics: wavefront control with a μ -mirror array and a VLSI stochastic gradient descent controller," **Applied Optics**, [40] 24 pp. 4243-4253, 2001
- Shanbhag, P. M., Feinberg, M.R., Sandri, G., Horenstein, M. N., and Bifano, T.G., "Ion-Beam Machining of Millimeter Scale Optics," **Applied Optics**, [39] 4 pp. 599 - 611, 2000
- Horenstein, M. N., Perreault, J. and Bifano, T. G., "Differential Capacitive Position Sensor for Planar MEMS Structures with Vertical Motion." **Sensors and Actuators** (80), pp 53-61, 2000
- Mali, R. K., Bifano, T. and Koester, D. A., "Design-based approach to planarization in multilayer surface micromachining," **J. Micromech. Microeng.** [9] pp. 294-299, 1999
- Horenstein, M., Bifano, T.G., Pappas, S., Perreault J., and Krishnamoorthy-Mali, R., "Real Time Optical Correction Using Electrostatically Actuated MEMS Devices." **Journal of Electrostatics**, Vol. 46, pp. 91-101, 1999
- Bifano, T. G., Perreault, J., Mali, R. K., and Horenstein, M. N., "Microelectromechanical Deformable Mirrors," **Journal of Selected Topics in Quantum Electronics**, [5], pp. 83-90, 1999
- Bifano, T. G., Krishnamoorthy, R., Caggiano, H., and Welch, E., "Fixed-Load Electrolytic Dressing with Bronze-Bonded Grinding Wheels," **ASME J. Manufacturing**, [121], pp. 20-27, 1999
- Vandelli, N, Wroblewski, D. E., Velonis, M., and Bifano, T. G., "Development of a MEMS Microvalve Array for Fluid Flow Control," **J. Microelectromechanical Systems**, [7], pp. 395-403, 1998
- Bifano, T. G., Mali, R., Perreault, J., Dorton, K., Vandelli, N, Horenstein, M., and Castanon, D., "Continuous membrane, surface micromachined silicon deformable mirror," **Optical Engineering** [36]5, pp. 1354-1360, 1997
- Bifano, T. G., Caggiano, H., and Bierden, P., "Precision Manufacture of Optical Disc Master Stampers," **J. Precision Eng'g** [20]1, pp. 53-62, 1997
- Bifano, T. G., and Bierden, P., "Fixed Abrasive Grinding of Brittle Hard Disk Substrates," **Intl. J. of Machine Tools**[37]7, pp. 935-946, 1997

- Horenstein, M.N., Bifano, T.G., Mali, R. K., Vandelli, N., "Electrostatic Effects in Micromachined Actuators for Adaptive Optics," **Journal of Electrostatics** [42], pp. 69-82, 1997
- Krishnamoorthy, R., Bifano, T. G., Vandelli, N., and Horenstein, M., "Development of MEMS deformable mirrors for phase modulation of light," **Optical Engineering** [36]2, pp. 542-548, 1997
- Scagnetti, P. A., Bifano, T. G., Nagem, R. J., and Sandri, G. vH., "Simulation of Micro-Indentation Using Molecular Dynamics Modeling," **ASME J. of Applied Mechanics**, [63], pp. 450-453, 1996
- Drueding, T., Bifano, T. G., and Fawcett, S. C., "Contouring Algorithm for Ion Figuring," **J. Precision Eng'g**, [17]1, pp. 10-21, 1995
- Drueding, T. W., Wilson, S., Fawcett, S. C., and Bifano, T. G., "Contouring Algorithm for Ion Figuring," **Optical Engineering**, [34]12, pp. 3565-3571, 1995
- Bifano, T. G. Kahl, W. K., and Yi, Y., "Fixed-Abrasive Grinding CVD Silicon Carbide Mirrors," **J. Precision Eng'g**, [16]2, pp. 109-116, 1994
- Fawcett, S. C., Bifano, T. G., and Drueding, T., "Neutral Ion Figuring of Chemically vapor Deposited Silicon Carbide," **Optical Engineering**, [33]3, pp. 967-974, 1994
- Bifano, T. G., Golini, D., and DePiero, D., "Chemomechanical Effects in Ductile-Regime Machining of Glass," **J. Precision Eng'g**, [15]4, pp. 238-247, 1993
- Bifano, T. G., and Hosler, J., "Precision Grinding of Ultra-Thin Quartz Wafers," **ASME J. Eng'g for Industry** [115]3, pp. 258-262, 1993
- Bifano, T. G., and Yi, Y. "Acoustic Emission as an Indicator of Material-Removal Regime in Glass Microgrinding," **J. Precision Eng'g** [14]4, pp. 219-228, 1992
- Scattergood, R. O., Srinivasan, S., Bifano, T. G., and Dow, T. A., "R-Curve Effects for Machining and Wear of Ceramics," **Ceram. Acta** [3]4-5, pp. 53-64, 1991
- Bifano, T. G., and Fawcett, S. C., "Specific Grinding Energy as an In-Process Control Variable for Ductile-Regime Grinding," **J. Precision Eng'g** [13]4, pp. 256-262, 1991
- Bifano, T. G., Dow, T. A., and Scattergood, R. O., "Ductile-Regime Grinding: A New Technology for Machining Brittle Materials," **ASME J. Eng'g for Industry** [113]2, pp. 184-189, 1991
- Blake, P., Bifano, T. G., Dow, T. A., and Scattergood, R. O., "Precision Machining of Ceramic Materials," **Amer. Ceramic Soc. Bulletin** [67]6, pp. 1038-1044, 1988
- Bifano, T. G., and Dow, T. A., "Real Time Control of Spindle Runout," **Optical Engineering** [24]5, pp. 888-892, 1985

Conference Publications

- Zhou Y, Bifano T, Lin C, "Adaptive optics two-photon scanning laser fluorescence microscopy," MEMS Adaptive Optics V, San Francisco, CA, SPIE, [7931], H1-8, (2011).
- Lu Y, Hoffman SM, Stockbridge CR, LeGendre AP, Stewart JB, Bifano TG, "Polymorphic optical zoom with MEMS DMs," MEMS Adaptive Optics V, San Francisco, CA, SPIE, [7931], D1-7, (2011).
- Horenstein MN, Sumner R, Miller P, Bifano T, Stewart J, Cornelissen S, "Ultra-low-power multiplexed electronic driver for high resolution deformable mirror systems," MOEMS and Miniaturized Systems X, San Francisco, CA, SPIE, [7930], M1-8, (2011).
- Cornelissen SA, Hartzell AL, Stewart JB, Bifano TG, Bierden PA, "MEMS deformable mirrors for astronomical adaptive optics," Adaptive Optics Systems II, San Diego, California, USA, SPIE, [7736], 77362D-77361, (2010).
- Bifano T, "Shaping light: MOEMS deformable mirrors for microscopes and telescopes," MEMS Adaptive Optics IV, San Francisco, California, USA, SPIE, [7595], 759502-

- 759508, (2010).
- Diouf A, Bifano TG, Legendre AP, Lu Y, Stewart JB, "Open loop control on large stroke MEMS deformable mirrors," MEMS Adaptive Optics IV, San Francisco, California, USA, SPIE, [7595], 75950D-75957, (2010).
- Diouf A, Bifano TG, Stewart JB, Cornelissen S, Bierden P, "Through-wafer interconnects for high degree of freedom MEMS deformable mirrors," MEMS Adaptive Optics IV, San Francisco, California, USA, SPIE, [7595], 75950N-75912, (2010).
- Chu KK, Leray A, Bifano TG, Mertz J, "Two-photon fluorescence microscopy with differential aberration imaging," *SPIE MEMS Adaptive Optics III*, San Jose, CA, USA, SPIE, [7209], 720903-720905, (2009).
- Bifano T, Schatzberg L, Stewart J, Cornelissen S, ASME, "MEMS Modulated retroreflectors for secure optical communication," *Proceedings of the Asme International Mechanical Engineering Congress and Exposition, Vol 13, Pts a and B*, New York, Amer Soc Mechanical Engineers, 395-399, (2009).
- Ziph-Schatzberg L, Bifano T, Cornelissen S, Stewart J, Bleier Z, "Deformable MEMS mirrors in secure optical communication system," *Micro- and Nanotechnology Sensors, Systems, and Applications*, Orlando, FL, USA, SPIE, [7318], 73180T-73112, (2009).
- Ziph-Schatzberg L, Bifano T, Cornelissen S, Stewart J, Bleier Z, "Secure optical communication system utilizing deformable MEMS mirrors," *SPIE MEMS Adaptive Optics III*, San Jose, CA, USA, SPIE, [7209], 72090C-72015, (2009).
- Chu K, Bifano Thomas G, Jerome M, "Two-Photon Differential Aberration Imaging Using a Modulating Retroreflector Mirror," *Novel Techniques in Microscopy*, Optical Society of America, NMD3, (2009).
- Chu K, Bifano TG, Mertz J, "Improvements in Two-Photon Fluorescence Microscopy," *Frontiers in Optics*, Optical Society of America, FWA2, (2009).
- Bifano T, "MEMS Wavefront Correctors," *Adaptive Optics: Methods, Analysis and Applications*, Optical Society of America, AOTHD1, (2009).
- Diouf, A., Gingras, M., Stewart, J.B., Bifano, T.G., Cornelissen, S.A. and Bierden, P.A., "Fabrication of single crystalline MEMS DM using anodic wafer bonding," Proc. SPIE 6888, 2008
- Cornelissen, S. A., Bierden, P., and Bifano, T. G., "A 4096 element continuous facesheet MEMS deformable mirror for high-contrast imaging," Proc. SPIE 6888, p.68880V 2008
- Bifano, T. G. Bierden, P., and Cornelissen, S. A. "MEMS deformable mirrors for space and defense applications," Proc. SPIE 6959, p.695914 2008
- Bifano, T. G., Stewart, J. and Diouf, A., "Precise open-loop control of MEMS deformable mirror shape," Proc. SPIE 6888, p.68880P, Jan. 2008
- Castillo, J., and Bifano, T. G., "Adaptive optics calibration for a wide-field microscope," Proc. SPIE 6888, p. 68880E Jan. 2008
- Zhou, Y., Bifano, T. and Lin, C., "Use of adaptive optics to increase nonlinear imaging signal in mouse bone marrow, Proc. SPIE 6888, p.688808, Jan 2008
- Bifano, T., Schatzberg, L., Stewart, J., and Cornelissen, S., "MEMS Modulated retroreflector for secure optical communication," Proceedings of IMECE2008, ASME International Mechanical Engineering Congress and Exposition, Boston, Massachusetts, paper # IMECE2008-66795 Nov., 2008
- Zhou, Y., Bifano, T. and Lin, C., "Adaptive optics two-photon fluorescence microscopy," Proc. SPIE Vol. 6467, MEMS Adaptive Optics, Scot S. Olivier, Thomas G. Bifano, Joel A. Kubby, Editors, p. 646705, Jan. 2007

- Biss, D. P., Webb, R. H., Zhou, Y., Bifano, T. G., Zamiri, P., Lin, C. P., Burns, S. A., "An adaptive optics biomicroscope for mouse retinal imaging," *Proc. SPIE Vol 6467, MEMS Adaptive Optics*, p. 646703, Jan. 2007
- Cornelissen, S. A., Bierden, P. A., and Bifano, T. G., "Development of a 4096 element MEMS continuous membrane deformable mirror for high contrast astronomical imaging," *Proc. SPIE Vol. 6306, Advanced Wavefront Control: Methods, Devices, and Applications IV*, Michael K. Giles, John D. Gonglewski, Richard A. Carreras, Editors, Aug, 2006
- Levine, B. M., Aguayo, F., Bifano, T., Fregoso, S. F., Green, J. J., Lane, B. F., Liu, D. T., Mennesson, B., Rao, S., Samuele, R., Shao, M., Schmidlin, E., Serabyn, E., Stewart, J., and Wallace, J. K., "The visible nulling coronagraph: architecture definition and technology development status," *Proc. SPIE Vol. 6265, Space Telescopes and Instrumentation I: Optical, Infrared, and Millimeter*, John C. Mather, Howard A. MacEwen, Mattheus W. M. de Grauw, Editors, Jun. 2006
- Zhou, Y., and Bifano, T., "Characterization of contour shapes achievable with a MEMS deformable mirror," *Proc. SPIE Vol. 6113*, p. 123-130, *MEMS/MOEMS Components and Their Applications III*; Scot S. Olivier, Srinivas A. Tadigadapa, Albert K. Henning; Eds., Jan 2006
- Stewart, J. B., Bifano, T., Bierden, P., Cornelissen, S., Cook, T., and Levine, B. M., "Design and development of a 329-segment tip-tilt piston mirror array for space-based adaptive optics," *Proc. SPIE Vol. 6113*, p. 181-189, *MEMS/MOEMS Components and Their Applications III*; Scot S. Olivier, Srinivas A. Tadigadapa, Albert K. Henning; Eds., Jan 2006
- Kim, D. J., Bifano, T., Cornelissen, S., Hubbard, A., "Chip-scale integrated driver for electrostatic DM control," *Proc. SPIE Vol. 6113*, p. 270-278, *MEMS/MOEMS Components and Their Applications III*; Scot S. Olivier, Srinivas A. Tadigadapa, Albert K. Henning; Eds. Jan 2006
- Bifano, T. G. and Stewart, J. B. "High-speed wavefront control using MEMS micromirrors," *Proc. SPIE Vol. 5895, Target-in-the-Loop: Atmospheric Tracking, Imaging, and Compensation II*, Michael T. Valley, Mikhail A. Vorontsov, Editors, 58950Q, Sep. 7, 2005
- Burns, S. A., Zhou, Y., Lin, C. P., Bifano, T. G., Veilleux, I., Webb, R. H., "Retinal imaging and wavefront sensing in mice," *Investigative Ophthalmology & Visual Science* 45:U1003-U1003, Suppl. 1., 2005
- Perreault, J. A., and Bifano, T., "High resolution wavefront control using micromirror arrays," *Proc. Solid-State Sensor, Actuator and Microsystems Workshop*, Hilton Head Island, South Carolina, pp. 83-86, 2004
- Bifano, T. G., Bierden, P. A., Zhu, H., Cornelissen, S., and Kim, J. H., Proc. "Megapixel wavefront correctors," *Proc. SPIE Vol. 5490, Advancements in Adaptive Optics*, Domenico Bonaccini Calia, Brent L. Ellerbroek, Roberto Ragazzoni, Editors, pp. 1472-1481, 2004
- Bifano, T. G., Bierden, P. A., and Perreault, J., "Micromachined deformable mirrors for dynamic wavefront control," *Proc. SPIE Vol. 5553, High-Resolution Wavefront Control: Methods, Devices, and Applications IV*, John D. Gonglewski, Editor, pp. 10-13, 2004
- Zhu, H., Bierden, P. A., Cornelissen, S., Bifano, T. G., and Kim, J. H., "Design and fabrication of reflective spatial light modulator for high-dynamic-range wavefront control," *Proc. SPIE Vol. 5553, Advanced Wavefront Control: Methods, Devices, and Applications II*, John D. Gonglewski, Mark T. Gruneisen, Michael K. Giles, Editors, pp. 39-45, 2004

- Becker, T. Bifano, T. G., Lee, H., Miller, M., Bierden, P. A., and Cornelissen, S., "MEMS spatial light modulators with integrated electronics," *Proc. SPIE Vol. 4983*, MOEMS and Miniaturized Systems III, James H. Smith, Editor, pp. 248-258, 2003
- Dimas, C. E., Perreault, J., Cornelissen, S., Dyson, H., Krulevitch, P., Bierden, P. A., and Bifano, T. G., "Large-scale polysilicon surface-micromachined spatial light modulator," *Proc. SPIE Vol. 4983*, MOEMS and Miniaturized Systems III, James H. Smith, Editor, pp. 204-210, 2003
- Lee, H., Miller, M., and Bifano, T. G., "Planarization of a CMOS die for an integrated metal MEMS," *Proc. SPIE Vol. 4979*, Micromachining and Microfabrication Process Technology VIII, John A. Yasaitis, Mary Ann Perez-Maher, Jean Michel Karam, Editors, January 2003, pp. 137-144, 2003
- Krulevitch, P., Bierden, P. A., Bifano, T., Carr, E., Dimas, C., Dyson, H., Helmbrecht, M., Kurczynski, P., Muller, R., Olivier, S., Peter, Y., Sadoulet, B., Solgaard, O., and Yang, E. H., "MOEMS spatial light modulator development at the Center for Adaptive Optics," *Proc. SPIE Vol. 4983*, p. 227-234, MOEMS and Miniaturized Systems III, James H. Smith, Peter A. Krulevitch, Hubert K. Lakner, Eds., 2003.
- Bifano, T. G., Perreault, J., A., Bierden, P. A., and Dimas, C. E., "Micromachined deformable mirrors for adaptive optics," *Proc. SPIE Vol. 4825*, p. 10-13, High-Resolution Wavefront Control: Methods, Devices, and Applications IV; John D. Gonglewski, Mikhail A. Vorontsov, Mark T. Gruneisen, Sergio R. Restaino, Robert K. Tyson; Eds., Nov 2002
- Dimas, C. E., Bifano, T. G., Bierden, P. A., Perreault, J. A., Krulevitch, P. A. Roehnelt, R. T., and Cornelissen, S. A., "Polysilicon surface-micromachined spatial light modulator with novel electronic integration," *Proc. SPIE Vol. 4755*, p. 477-484, Design, Test, Integration, and Packaging of MEMS/MOEMS 2002; Bernard Courtois, Jean Michel Karam, Karen W. Markus, Bernd Michel, Tamal Mukherjee, James A. Walker; Eds., Apr 2002
- Bifano, T. G. Bierden, P. A., Cornelissen, S. A. Dimas, C. E., Lee, H. Miller, M.H., and Perreault, J. A., "Large-scale metal MEMS mirror arrays with integrated electronics," *Proc. SPIE Vol. 4755*, p. 467-476, Design, Test, Integration, and Packaging of MEMS/MOEMS 2002; Bernard Courtois, Jean Michel Karam, Karen W. Markus, Bernd Michel, Tamal Mukherjee, James A. Walker; Eds., Apr 2002
- Reimann, G., Perreault, J., A., Bierden, P. A., and Bifano, T. G., "Compact adaptive optical compensation systems using continuous silicon deformable mirrors," *Proc. SPIE Vol. 4493*, p. 35-40, High-Resolution Wavefront Control: Methods, Devices, and Applications III; John D. Gonglewski, Mikhail A. Vorontsov, Mark T. Gruneisen; Eds., Feb 2002
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- 2010 Andrew Legendre, MSME
- 2009 Alioune Diouf, PhD ME, Dissertation: MEMS DMs in Next Generation Telescopes
- 2008 Y. Zhou, PhD MfgE Dissertation: AO two photon fluorescence microscopy
- 2008 J. Stewart, PhD EE Dissertation: Segmented DM for astronomical imaging
- 2008 D.J. Kim, PhD EE Dissertation: Integrated Drivers for Large Scale MEMS Arrays
- 2008 M. Gingras, MSMfgE
- 2008 J. Castillo, MSEE
- 2007 J. H. Kim, PhD MfgE Dissertation: Manufacture of a Reflective Spatial Light Modulator

2007 G. Thompson, MSMfgE
2007 M. Lewis, MSME
2005 S. Kratz, MSMfgE
2005 J. Perreault PhD EE Dissertation: High Resolution MEMS Deformable Mirrors
2005 D. Sumorock, MSEE
2005 Y. Zhou, MSME
2004 G. Reimann, MSMfgE
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2001 C. Reheman, MSMfgE
2000 C. Hodge, MSME
2000 M. Bancu, MSME
2000 D. Malkani, MSME
1999 N. Vandelli, Ph.D.ME Dissertation: MEMS Microvalve Arrays for Flow Control
1999 P. Shanbhag, MSME
1999 M. Feinberg, MSME
1998-99 Nicholas Rosen, Postdoctoral Researcher
1998 R. K. Mali, PhD, ME Dissertation: Surface Micromachined Deformable Mirrors
1997 H. E. Caggiano, PhD ME Dissertation: New method of Mfg CD Masters
1995 T. W. Drueding, PhD, ME Dissertation: Ion Figuring of Centimeter-Scale Optics
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1993 Y. Yi, PhD, ME Dissertation: Ultraprecision Grinding of Ceramic Mirrors
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