

Curriculum Vitae

Name: **Roberto Ballarini, Ph.D., P.E., F.ASCE, F.EMI**
Registered Professional Engineer, State of Texas, No. 99081

Citizenship: U.S.A.

Education:
Ph.D. 1985 Northwestern University, Civil Engineering
M.S. 1981 Northwestern University, Civil Engineering
B.E. 1980 City College of New York, Civil Engineering

Employment:

9/14-present **University of Houston**
Thomas and Laura Hsu Professor and Chair, Department of Civil and Environmental Engineering

7/06-9/14 **University of Minnesota**
James L. Record Chair (Head '07-'12), Department of Civil Engineering (courtesy appointments in the Departments of Biomedical Engineering, Mechanical Engineering, Chemical Engineering and Materials Science)

8/86-7/06 **Case Western Reserve University**
Leonard Case Jr. Professor of Engineering ('04-'06)
Professor of Civil Engineering, Mechanical and Aerospace Engineering, Materials Science and Engineering ('97-'03)
Associate Professor ('92-'97)
Assistant Professor ('86-92)

7/03-6/04 **Franklin W. Olin College of Engineering**
F.W. Olin Professor of Mechanical Engineering

7/85 -7/86 **Cleveland State University**
Assistant Professor of Civil Engineering

1/85-7/85 **Shell Development Company, Houston, Texas**
Associate Research Engineer

Sabbatical Leaves and Invited Visits

Polytechnic of Madrid (6/14), Tsinghua University (Beijing) (6/13), University of Palermo (5/13), University of Genova (6/07-7/07), University of Minnesota (3/06, 2/95-5/95), University of Pisa (7/95, 7/05-8/05), Politecnico di Torino (5/90-7/90)

Selected Honors and Awards:

Inaugural Fellow, ASCE Engineering Mechanics Institute, 2013
President, ASCE Engineering Mechanics Institute, 1/13-present
ASCE Fellow, 11/07
John S. Diekhoff Award for Distinguished Graduate Teaching, CWRU, 2000

Editorial Activities

Editor-in-Chief, ASCE Journal of Engineering Mechanics (7/12-present)
Editorial Board, Journal of the Mechanical Behavior of Materials (5/13-present)
Editorial Board, Lecture Notes in Mechanics, ASCE Engineering Mechanics Institute (9/10-present)
Associate Editor, Journal of the American Ceramic Society ('05-present)
Associate Editor, Journal of Nano Research ('07-present)

Research:

My research focuses on the development and application of theoretical, computational and experimental techniques to characterize the response of materials and structures to mechanical, thermal, and environmental loads. I am particularly interested in characterizing the mechanics of fatigue and fracture. My multidisciplinary research, which has been funded by the *National Science Foundation*, *DARPA*, the *National Institutes of Health*, the *Office of Naval Research*, the *United States Air Force*, *NASA* and the *Ohio and Minnesota Departments of Transportation* has been applied to problems arising in civil engineering, mechanical and aerospace engineering, materials science, electromechanical systems, biological tissues and prosthetic design. I have published approximately one hundred papers in the top refereed journals, including *Science* and *Nature*, and several of my research projects have been featured in the popular press, including the *New York Times Science Times*, *American Scientist*, *Science News*, *Business Week*, *Financial Times*, *Geo*, *Pour La Science* and *Industry Week*.

My current research involves the design and testing of a new earthquake energy dissipation system for steel structures, size effects in concrete structures, statistical strength distributions in glass and other types of ceramics, fiber reinforced plastics bonded to concrete and to steel substrates, fracture mechanics-based design of pavements, bioinspired design of damage tolerant composites, reliability of microelectromechanical systems (MEMS) devices, structural testing of nanoscale biological and synthetic materials such as collagen fibrils and carbon nanotubes, computational materials science, and multiscale modeling of heterogeneous materials.

Publications:

Articles in Magazines and Popular Books

6. R. Ballarini and M. Liao, "The Infamous Gusset Plates," in *The City, The River, the Bridge*, edited by Patrick Nunnally, University of Minnesota Press, 2011.

5. R. Ballarini and A.H. Heuer, "Des Secrets dans la Coquille," *Pour La Science* (French edition of *Scientific American*), No. 372, Octobre 2008, 86-92.
4. R. Ballarini and A.H. Heuer, "Secrets in the Shell," *American Scientist*, September-October 2007, 422-429.
3. R. Ballarini, "Da Vinci-Euler-Bernoulli Beam Theory?," *ASME Mechanical Engineering Magazine Online*, 4/18/03.
2. H. Kahn, A.H. Heuer and R. Ballarini, "On-Chip Testing of Mechanical Properties of MEMS Devices", *MRS Bulletin (special issue MEMS: Technology and Applications)*, April 2001, pp. 300-301
1. D.G. Lewicki and R. Ballarini, "Gear Crack Propagation Life Investigations," *Gear Technology*, Nov./Dec. 1997, pp. 18-24.

Books

Materiomics: Multiscale Mechanics of Biological Materials and Structures, CISM International Centre for Mechanical Sciences Courses and Lectures Vol. 546, Springer 2013 (with M.J. Buehler).

Refereed Journal Articles

103. R. Ballarini, G. Pisano and G. Royer-Carfagni, "Is There a Lower Bound for Glass Strength? A Statistical Approach *a la* Weibull for Structural Applications, submitted.
102. R. Ballarini, G. Pisano and G. Royer-Carfagni, "New Calibration of Partial Material Factors for the Structural Design of Float Glass. Comparison of Bounded and Unbounded Statistics for Glass Strength," submitted.
101. K.B. Nakshatrala, R. Ballarini, M. Shabouei and M.G. Kapugantix, "On the Behavior of Degrading Structural Members Under Small Strains Using Multi-Physics Modeling," in preparation.
100. R. Ballarini and Y. Xie, "Fracture Mechanics Formula for Load-Carrying Capacity of Group Anchors," submitted to *Engineering Fracture Mechanics*.
99. R. Ballarini, L. La Mendola, J. Le, A. Monaco, "Computational Investigation of the Size Effect of Hybrid Steel Trussed Concrete Beams (HSTCBs)," submitted.
98. S. Adibi, P.S. Brancio and R. Ballarini, "Compromising High Strength and Ductility in Nanoglass-metallic Glass Nanolaminates," to appear in *Royal Society of Chemistry Advances*.
97. Y. Liu, R. Ballarini and S.J. Eppell, "Tension Tests on Mammalian Collagen Fibrils," *Interface Focus* 6: 20150080, 2015.
96. W.W. Gerberich, R. Ballarini, E.D. Hintsala, M. Mishra, J-F Molinari and I. Szlufarska, "Mohs Hardness Scale Demystified," Feature Article in September issue of *Journal of the American Ceramic Society*, Vol. 98, No. 9, 2681-2688, 2015.
95. J. Le, R. Ballarini and Z. Zhu, "Modeling of Probabilistic Failure of Polycrystalline Silicon MEMS Structures," Feature Article and Cover Page in June issue of *Journal of the American Ceramic Society*, Vol. 98, Issue 6, 1685-1697, June 2015.
94. I. Ostanin, R. Ballarini and T. Dumitrica, "Distinct Element Method for Multiscale Modeling of Cross-Linked Carbon Nanotube Bundles: From Soft to Strong Nanomaterials," *Journal of Materials Research*, Vol. 30, No. 1, Jan. 2015, pp. 19-25.
93. R. Ballarini, A. Franco and G. Royer-Carfagni, "Wedge-Shaped Fracturing in the Pull Out of FRP Stiffeners from Quasi-Brittle Substrates," *International Journal of Solids and Structures*, Vol. 51, Issue 18, September 2014, 3196-3208.

92. I. Ostanin, R. Ballarini and T. Dumitrica, "Distinct Element Modeling of Carbon Nanotube Bundles with Intertube Sliding and Dissipation," *ASME Journal of Applied Mechanics*, Vol. 81, Issue 6, June 2014.
91. A. Gautieri, S. Vesentini, A. Redaelli and R. Ballarini, "Modeling and Measuring Viscoelastic Properties: From Collagen Molecules to Collagen Fibrils," *International Journal of Non-Linear Mechanics*, Vol. 56, pp. 25-33, 2013 (published online <http://dx.doi.org/10.1016/j.ijnonlinmec.2013.03.012i>).
90. J. Le, M. Pieuchot and R. Ballarini, "Effect of Stress Singularities on Scaling of Strength of Quasibrittle Structures," *ASCE Journal of Engineering Mechanics*, Vol. 140, Issue 5, May 2014 (posted online 10.1061/(ASCE)EM.1943-7889.0000693 (Jul. 10, 2013)).
89. D. Giannuzzi, R. Ballarini, A. Huckelbridge, Jr., M. Pollino and M. Valente, "Braced Ductile Shear Panel: a New Seismic Resistant Framing System," *ASCE Journal of Structural Engineering*, Vol. 140(2),0401305, 2014 (posted online 10.1061/(ASCE)ST.1943-541X.0000814, Feb. 1, 2013).
88. I. Ostanin, R. Ballarini, D. Potyondy and T. Dumitrica, "A Distinct Element Method for Large Scale Simulations of Carbon Nanotube Assemblies," *Journal of the Mechanics and Physics of Solids*, Vol. 61, pp. 762-782, 2013.
87. M. Liao and R. Ballarini, "Towards a Fracture Mechanics-Based Design Approach for Unbonded Concrete Overlay Pavements," *ASCE Journal of Engineering Mechanics*, Vol. 138, No. 9, pp. 1195-1204. 2012.
86. R. Piccinin, R. Ballarini and S. Cattaneo, "Pullout Capacity of Headed Anchors in Prestressed Concrete," *ASCE Journal of Engineering Mechanics*, Vol. 138, No. 7, pp. 877-887, 2012.
85. L.M. Hale, D.-B. Zhang, X. Zhou, J.A. Zimmerman, N.R. Moody, T. Dumitrica, R. Ballarini and W.W. Gerberich, "Dislocation Morphology and Nucleation within Compressed Si Nanospheres: A Molecular Dynamics Study," *Computational Materials Science*, Vol. 54, pp. 280-286, 2012.
84. L.M. Hale, X. Zhou, J.A. Zimmerman, N.R. Moody, R. Ballarini and W.W. Gerberich, "Phase Transformations, Dislocations and Hardening Behavior in Uniaxially Compressed Silicon Nanospheres," *Computational Materials Science*, Vol. 50, Issue 5, pp. 1651-1660, 2011.
83. R. Ballarini, S. Jost and M. Liao, "Distributed Damage Creates Flaw Tolerance," *Engineering Fracture Mechanics*, Vol. 78, Issue 9, pp. 2004-2009, 2011 .
82. Y. Ganesan, C. Peng, Y. Lu, P.E. Loya, P. Moloney, E. Barrera, B. I. Yakobson, J.M. Tour, R. Ballarini and J. Lou, "Interface Toughness of Multi-wall Carbon Nanotube Reinforced Epoxy Composites," *ACS Applied Materials and Interfaces*, Vol. 3, Issue 2, pp. 129-134, 2011.
81. Z.L. Shen, H. Kahn, R. Ballarini and S.J. Eppell, "Viscoelastic Properties of Isolated Collagen Fibrils," *Biophysical Journal*, Vol. 100, pp. 3008-3014, June 2011.
80. Y. Tang and R. Ballarini, "A Theoretical Analysis of the Breakdown of Electrostrictive Oxide Film on Metal", *Journal of the Mechanics and Physics of Solids*, Vol. 59, Issue 2, pp. 178-193, 2011 (published first online doi:10.1016/j.jmps.2010.11.002).
79. A.R. Beaber, J.D. Nowak, O. Ugurlu, W. M. Mook, S.L. Girshick, R. Ballarini and W.W. Gerberich, "Smaller is Tougher," *Philosophical Magazine*, Vol. 91, Issue 7-9, pp. 1179-1189, 2011 (first published on 25 June 2010 (iFirst), doi:10.1080/14786435.2010.487474).
78. R. Ballarini and P. Villaggio, "Elastic Stress Diffusion Around a Thin Corrugated Inclusion," *IMA Journal of Applied Mathematics*, Vol. 76, Issue 4, pp. 633-641, 2011 (advanced access published January 7, 2011, pp. 1-9, doi:10.1093/imamat/hqx070).

77. M. Liao, T. Okazaki, R. Ballarini, A. Schultz, T. Galambos, "Nonlinear Finite Element Analysis of Critical Gusset Plates in the I-35W Bridge in Minnesota," *ASCE Journal of Structural Engineering*, Vol. 137, Issue 1, pp. 59-68, 2011 (posted ahead of print July 15, 2010 doi:10.1061/(ASCE)ST.1943-541X.0000269).
76. T. Anderson, E. Akatyeva, I. Nikiforov, D. Potyondy, R. Ballarini and T. Dumitrica, "Towards Distinct Element Simulation of Carbon Nanotube Systems," *ASME Journal of Nanotechnology in Engineering and Medicine*, Vol. 1, 041009, 2010.
75. Z.L. Shen, M.R. Hodge, H. Kahn, R. Ballarini and S.J. Eppell, "In-Vitro Fracture Testing of Submicron Diameter Collagen Fibrils Under Uniaxial Testing," *Biophysical Journal*, Vol. 99, 1986-1995, 2010.
74. H. Kahn, R. Ballarini and A.H. Heuer, "Using Microfabricated Devices to Determine the Fracture Strength of Materials," *International Journal of Materials Research*, Vol. 101, No. 1, pp. 102-105, 2010.
73. R. Piccinin and R. Ballarini, "Linear Elastic Fracture Mechanics Pullout Analyses of Headed Anchors in Stressed Concrete," *ASCE Journal of Engineering Mechanics*, Vol. 136, No. 5, pp. 761-768, 2010.
72. Y. Ganesan, Y. Lu, C. Peng, H. Lu, R. Ballarini and J. Lou, "Development and Application of a Novel Micro-fabricated Device for *In Situ* Tensile Testing of 1-D Nanomaterials," *Journal of Microelectromechanical Systems*, Vol. 19, No. 3, pp. 675-682, 2010.
71. L.M. Hale, X.W. Zhou, J.A. Zimmerman, N.R. Moody, R. Ballarini and W.W. Gerberich, "Molecular Dynamics Simulation of Delamination of a Stiff, Body-Centered-Cubic Crystalline Film from a Compliant Si Substrate," *Journal of Applied Physics*, Vol. 6, No. 8, 083503-083503-7, Oct. 2009.
70. Y. Tang, R. Ballarini, M.J. Buehler and S.J. Eppell, "Deformation Micromechanisms of Collagen Fibrils Under Uniaxial Tension," *Journal of the Royal Society Interface*, Vol. 7, pp. 839-850, 2010 (published first online November 6, 2009, doi: 10.1098/rsif.2009.0390).
69. S. Mogilevskaia, H. Stolarski, R. Ballarini and S. Crouch, "Interaction Between a Crack and an Inhomogeneity with Surface Elasticity and Surface Tension," *International Journal of Fracture*, Vol. 159, pp. 191-207, 2009.
68. F. Ostlund, K. Rzepiejewska-Malyska, K. Leifer, L.M. Hale, Y. Tang, R. Ballarini,, W.W. Gerberich and J. Michler, "Brittle-to-Ductile Transition in Uniaxial Compression of Silicon Pillars at Room Temperature," *Advanced Functional Materials*, Vol. 19, 2439-2444, 2009.
67. W. Gerberich, J. Michler, W.M. Mook, R. Ghisleni, F. Ostlund, D.D. Stauffer and R. Ballarini, "Scale Effects for Strength, Ductility and Toughness in 'Brittle Materials'," *Journal of Materials Research*, Vol. 24, No. 3, 898-906, March 2009.
66. B.L. Boyce, R. Ballarini and I. Chasiotis, "An Argument for Proof-Testing Brittle Microsystems in High-Reliability Applications," *Journal of Micromechanics and Microengineering*, Vol. 18, 2008 117001 (4pp), doi:10.1088/0960-1317/18/11/117001.
65. Z.L. Shen, M.R. Dodge, H. Kahn, R. Ballarini and S.J. Eppell, "Stress-strain Experiments on Individual Collagen Fibrils," *Biophysical Journal*, Vol. 95, 2008, 3956-3963.
64. A. Avishai, H. Kahn, R. Ballarini and A.H. Heuer, "FIB and HRTEM Characterization of Surface Oxides on Polysilicon MEMS after Cyclic Loading," *Microscopy and Microanalysis*, Supplement S2, 2008, 1010-1011 (DOI: 10.1017/S1431927608085917).

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62. Y. Wang and R. Ballarini, "Crack-tip Parameters in Polycrystalline Plates with Soft Grain Boundaries," *ASCE Journal of Engineering Mechanics*, Vol. 134, No. 1, 100-109, 2008.
61. W.W. Gerberich, W.M. Mook, J.Deneen Nowak, C.B. Carter and R. Ballarini, "A Crack Extension Force Correlation for Hard Materials," *International Journal of Fracture*, Vol. 148, 109-114, 2007.
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59. L. Chen, R. Ballarini, H. Kahn and A.H. Heuer, "A Bioinspired Micro-Composite Structure," *Journal of Materials Research*, Vol. 22, No. 1, 124-131, 2007.
58. R. Ballarini and P. Villaggio, "Frobenius' Method for Curved Cracks," *International Journal of Fracture*, Vol. 139, pp. 59-69, 2006.
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55. H. Kahn, R. Ballarini and A.H. Heuer, "Mechanical Fatigue of Polysilicon: Effects of Mean Stress and Stress Amplitude," *Acta Materialia*, Vol. 54, pp. 667-678, 2006.
54. R. Ballarini, R. Kayacan, F.J. Ulm, T. Belytschko and A.H. Heuer, "Biological Structures Mitigate Catastrophic Failure Through Various Strategies," *International Journal of Fracture*, Vol. 135, pp. 187-197, 2005.
53. J.J. Bellante, H. Kahn, R. Ballarini, C.A. Zorman, M. Mehregany and A.H. Heuer, "Fracture Toughness of Polycrystalline Silicon Carbide Thin Films," *Applied Physics Letters*, Vol. 86, Article 071920, 2005.
52. Y. Wang, R. Ballarini, H. Kahn and A.H. Heuer, "Determination of the Growth Strain of LPCVD Polysilicon," *Journal of Microelectromechanical Systems*, Vol. 14, No. 1, pp. 160-166, 2005.
51. Y. Wang and R. Ballarini, "A Long Crack Penetrating a Transforming Inhomogeneity," *Journal of Applied Mechanics*, Vol. 71, pp. 582-585, 2004.
50. R. Ballarini, L. Chen and M. Grigoriu, "Crack Propagation in a Material with Random Toughness," *International Journal of Fracture*, Vol 125, pp. 353-369, 2004.
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46. Y. Wang and R. Ballarini, "A Long Crack Penetrating a Circular Inhomogeneity," *Meccanica* (special issue in honor of Professor Piero Villaggio), Vol. 38, pp. 579-593, 2003.

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41. S. Kamat, X. Su, R. Ballarini and A.H. Heuer, "Structural Basis for the Fracture Toughness of the Shell of the Conch *Strombus Gigas*," *Nature*, Vol. 405, June 29, pp. 1036-1040, 2000.
40. L. Brandinelli and R. Ballarini, "Stress Intensity Factor Approximations for Two Dimensional Curvilinear Cracks," *Composites Science and Technology*, Special Issue Dedicated to the 65th Anniversary of Dr. Nicholas Pagano, Vol. 82, pp. 274-280, 2000.
39. H. Kahn, N. Tayebi, R. Ballarini, R.L. Mullen and A.H. Heuer, "Fracture Toughness of Polysilicon MEMS Devices," *Sensors and Actuators*, (Transducers '99 Special Volume), Vol. 82, pp. 272-280, 2000.
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35. R. Kayacan, R. Ballarini and R.L. Mullen, "The Effects of Tooth and Implant Mobility on Occlusal Force Transmission in Tooth/Implant Supported Prostheses," *The Journal of Prosthetic Dentistry*, Vol. 78, No. 4, pp. 391-399, October 1997.
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32. D.G. Lewicki and R. Ballarini, "Gear Crack Propagation Life Investigations," *International Journal of Fracture*, Vol. 87, pp. 58-86, 1997 (also appeared as a feature article in *Gear Technology*, Nov./Dec. 1997, pp. 18-24).
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18. R. Ballarini and S. Muju, "Stability Analysis of Bridged Cracks in Brittle Matrix Composites," *ASME Journal of Engineering for Gas Turbines and Power*, Vol. 115, January 1993, pp. 127-138.
17. H. Luo, R. Ballarini and J.J. Lewandowski, "Effects of Superposed Hydrostatic Stress on the Elastoplastic Behavior of Two-Phase Composites," *Journal of Composite Materials*, Vol. 26, No. 13, pp. 1945-1967, 1992.
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14. R. Ballarini and Y. Hsu, "Three-Dimensional Stress Intensity Factor Analysis of a Surface Crack in a High Speed Bearing," *International Journal of Fracture*, Vol. 46, 1990, pp. 141-158.
13. R. Ballarini, "A Rigid Line Inclusion at a Bimaterial Interface," *Engineering Fracture Mechanics*, Vol. 37, No. 1, pp. 1-5, 1990.
12. R. Ballarini and S. Ahmed, "Local-Global Analysis of Crack Growth in Continuously Reinforced Ceramic Matrix Composites," *ASME Journal of Engineering for Gas Turbines and Power*, Vol. 112, October 1990, pp. 512-520.
11. R. Ballarini, "A Semi-Empirical Analysis of Micro-Cracking in Concrete," *Engineering Fracture Mechanics*, Vol. 35, No. 1/2/3, pp. 55-66, 1990.

10. R. Ballarini, A. Parulekar and M.E. Plesha, "Finite Element Modeling of Discontinuities with Dilatancy and Surface Degradation," *Engineering Fracture Mechanics*, Vol. 35, No. 1/2/3, pp. 385-397, 1990.
9. M.E. Plesha, R. Ballarini and A. Parulekar, "A Constitutive Model and Finite Element Solution Procedure for Contact-Friction Problems," *ASCE Journal of Engineering Mechanics*, Vol. 115, No. 12, December 1989, pp. 2649-2668.
8. R. Ballarini and M. Denda, "*The Interaction Between a Crack and a Dislocation Dipole*," *International Journal of Fracture*, Vol. 37, 1988, pp. 61-71.
7. R. Ballarini and M.E. Plesha, "The Effects of Crack Surface Friction and Roughness on Crack Tip Stress Fields," *International Journal of Fracture*, Vol. 34, July 1987, pp. 195-207.
6. R. Ballarini, L.M. Keer and S.P. Shah, "An Analytical Model for the Pullout of Rigid Anchors," *International Journal of Fracture*, Vol. 33, February 1987, pp. 75-94.
5. Ballarini, "An Integral Equation Approach for Rigid Line Inhomogeneity Problems," *International Journal of Fracture*, Vol. 33, February 1987, R23-R26.
4. R. Ballarini, "Compliance Matrices for Cracked Bodies," *International Journal of Fracture*, Vol. 31, August 1986, pp. R63-R66.
3. R. Ballarini, S.P. Shah and L.M. Keer, "Failure Characteristics of Short Anchor Bolts Embedded in a Brittle Material," *Proceedings of the Royal Society of London*, A404, pp. 35-54, 1986.
2. R. Ballarini, S.P. Shah and L.M. Keer, "Crack Growth in Cement Based Composites," *Engineering Fracture Mechanics*, Vol. 20, No. 3, pp. 433-445, 1984.
1. L.M. Keer and R. Ballarini, "Smooth Contact Between a Rigid Indenter and an Initially Stressed Orthotropic Beam," *A.I.A.A. Journal*, Vol. 21, No. 7, July 1983, pp. 1035-1042.

Reviews and Book Chapters

7. R. Ballarini and M. Liao, "The Infamous Gusset Plates," *The City, The River, the Bridge*, edited by Patrick Nunnally, University of Minnesota Press, 2010.
6. R. Ballarini, H. Kahn, A.H. Heuer, M.P. de Boer and M.T. Dugger, "MEMS Structures for on-Chip Testing of Mechanical and Surface Properties of Thin Films," in Comprehensive Structural Integrity: Fracture of Materials from Nano to Macro, Volume 8: Interfacial and Nanoscale Failure, Edited by W. Gerberich and W. Yang, Chapter 8.09, pp. 325-356, Elsevier Science, 2003.
5. A.H. Heuer, X. Su, S. Kamat and R. Ballarini, "Mollusk Shells: Structure/Property Relationships," in Encyclopedia of Materials: Science and Technology, Edited by K.H.J. Buschow, R.W. Cahn, M.C. Flemings, B. Ilschner, E.J. Kramer and S. Mahajan, Elsevier Science, 2001.
4. R. Ballarini, "The Role of Mechanics in Microelectromechanical Systems Technology," AFRL-ML-WP-TR-1998-4209, 146 pages, October 1998.
3. R. Ballarini and S.P. Shah, "Fracture Mechanics Based Analyses of Pull-Out Tests and Anchor Bolts," in Analysis of Concrete Structures by Fracture Mechanics, Chapman and Hall, 1991, pp. 245-280.
2. R. Ballarini, S. Ahmed and R.L. Mullen, "Finite Element Modeling of Frictionally Restrained Composite Interfaces," in Interfaces in Metal-Ceramic Composites, edited by R.Y. Lin, R.J. Arsenault, G.P. Martins and S. Fishman, The Minerals, Metals and Materials Society, Warrendale, PA, 1989, pp. 349-388.

1. R. Ballarini, S.P. Shah and L.M. Keer, "Nonlinear Analysis for Mixed-Mode Fracture," in Application of Fracture Mechanics to Cementitious Composites, Martinus Nijhoff, 1985, pp. 51-83.

Invited Talks

Since 2007 I have given numerous invited talks (too many to list here) related to the Nation's infrastructure to professional and policy making organizations.

105. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," Department of Civil and Environmental Engineering, Rice University, December 4, 2015.
104. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," Department of Aerospace Engineering and Mechanics, University of Texas at Austin, October 8, 2015.
103. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, September 21, 2015.
102. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," Keynote Lecture at ASME 2015 4th Global Conference on Nanoengineering for Medicine and Biology, Minneapolis, April 19-22, 2015.
101. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," Houston Methodist Research Institute, January 14, 2015.
100. "Reverse Engineering of Biological Structures," Hong Kong Polytechnic University, January 6, 2015.
99. "Structural Testing at the Micro and Nano Scales," Public Lecture organized by Hong Kong Polytechnic University, January 5, 2015.
98. "Testing Collagen Fibrils Using MEMS Platforms," 7th World Congress of Biomechanics, Boston, MA, July 9, 2014.
97. "Reverse Engineering of Biological Structures," Department of Materials Science, Universidad Politécnic de Madrid, June 18, 2014.
96. "Structural Testing at the Micro and Nano Scales," Department of Materials Science, Universidad Politécnic de Madrid, June 17, 2014.
95. "Structural Testing at the Micro and Nano Scales," Department of Civil and Environmental Engineering, Georgia Institute of Technology, June 19, 2014.
94. "Structural Testing at the Micro and Nano Scales," Department of Civil and Environmental Engineering, University of Houston, March 17, 2014
93. "Breaking Invisible Specimens with Zero Force," Department of Engineering Mechanics, Tsinghua University, Beijing, China, June 14, 2013.
92. "Effects of Stress Singularities on Scaling of Quasibrittle Fracture," the 13th International Conference on Fracture, June 16-21, 2013, Beijing.
91. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," the 13th International Conference on Fracture, June 16-21, 2013, Beijing.
90. "Distributed Damage Creates Flaw Tolerance," the 13th International Conference on Fracture, June 16-21, 2013, Beijing.

89. "Structural Testing at the Micro and Nano Scales," Advances in Computational Mechanics, a Conference Celebrating the 70th Birthday of Thomas J.R. Hughes, February 27, 2013.
88. "Breaking Invisible Specimens with Zero Force," presented to the Department of Mechanical Engineering, Boston University, February 1, 2013.
87. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," presented to the Department of Civil and Environmental Engineering, Northwestern University, November 20, 2012.
86. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," presented to the Department of Mechanical and Aerospace Engineering, Illinois Institute of Technology, November 19, 2013.
85. "Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force," presented to the Department of Civil and Environmental Engineering, University of Massachusetts at Amherst, October 19, 2012.
84. "Distributed Damage Creates Flaw Tolerance," invited talk at the Symposium Honoring the 75th Birthday of Zdenek Bazant, 49th Annual Meeting of the Society of Engineering Science, Atlanta, Georgia, October 10, 2012.
83. "An Academic Investigation of the I-35W Bridge Collapse," Luminary Session Invited Talk, Prognostic Health Management Society Conference 2012, Minneapolis, Minnesota, September 26, 2012.
82. "The Importance of Infrastructure to National Security and Culture," Keynote Lecture, 11th Annual Conference of the Chinese Overseas Transportation Association, Beijing, China, August 4, 2012.
81. "Structural Testing at the Micro and Nano Scales," Department of Mechanical Engineering, Tufts University, April 19, 2012.
80. "Structural Testing at the Micro and Nano Scales," Biointerest Group, University of Illinois at Urbana-Champaign, October 20, 2011.
79. "Mechanical Testing and Computational Modeling of Individual Collagen Fibrils," Society of Engineering Science 2011 Technical Meeting, Northwestern University, October 12, 2011.
78. "Structural Testing at the Micro and Nano Scales," presented at "Innovations in Mechanical Testing: From Molecules to Large Engineering Structures," a workshop sponsored by ASM-International, Oak Ridge National Laboratory, April 19, 2011.
77. "Cracking the Conch Conundrum: Tough Ceramics at the Seashore," presented to the Department of Civil Engineering at University of South Carolina, February 11, 2011.
76. "Collagen Fibrils: Experiments and Computational Modeling," Special Structures Seminar, Department of Civil Engineering, Northwestern University," July 8, 2010.
75. "Reverse Engineering of Biological Structures," Keynote Lecture, 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials, Virginia Tech, June 26, 2009.
74. "Cracking the Conch Conundrum: Tough Ceramics at the Seashore," presented to the Department of Civil Engineering at Columbia University, March 24, 2009.
73. "Structural Testing at the Micro and Nano Scales," presented to the Department of Civil Engineering at City College of New York, March 19, 2009.
72. "Investing in Infrastructure: The Effects of our Decaying Infrastructure on our National Security and Culture," Institute of Technology Public Lecture Series, University of Minnesota, November 19, 2008.

71. "Breaking Invisible Specimens with Zero Force," Sandia National Laboratories, Albuquerque, New Mexico, 3/31/08.
70. "Breaking Invisible Specimens with Zero Force," workshop on Strength and Fracture Standards at the Micro and Nano Scales, American Ceramic Society Meeting, Daytona Beach, 1/27/08.
69. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Café Scientifique, 12/11/07.
68. "Structural Fatigue in our Nation's Transportation Infrastructure," Oberstar Forum on Infrastructure, 10/8/07.
67. "Biological Structures Mitigate Catastrophic Fracture through Various Strategies," Department of Aerospace and Mechanics, University of Texas at Austin, 9/28/07.
66. Cyclic Load Induced Weakening and Strengthening of MEMS Silicon, Symposium on Fundamental and Characterization (Fundamentals of Brittle Fracture session), Materials, Structures and Technology Conference (MS&T'07), Detroit, 9/19/07.
65. "Tensile Testing of Collagen Fibril Using a MEMS Platform," 9th U.S. National Congress on Computational Mechanics, San Francisco, 7/25/07.
64. "Tensile Testing of Collagen Fibril Using a MEMS Platform," International Workshop on The Interplay Between Mechanics and Biology on Multiple Length Scales, Castro Urdiales, Spain, 7/1/07-7/4/07.
63. "Biological Structures Mitigate Catastrophic Fracture through Various Strategies," Department of Civil Engineering, M.I.T., 4/3/07.
62. "Bioinspired Design of Composite Materials," Department of Civil Engineering, Tufts University, 4/2/07.
61. "Structural Testing at the Micro and Nano Scales," Department of Aerospace Engineering and Mechanics, University of Minnesota, Dec. 1, 2006.
60. "Structural Testing at the Micro and Nano Scales," Department of Civil Engineering, University of Thessaly, Greece, July 20, 2006.
59. "Fracture Mechanics of Mollusks Shells," Department of Civil Engineering, University of Thessaly, Greece, July 20, 2006.
58. "Biological Structures Mitigate Catastrophic Fracture Through Various Strategies," 19th Panhellenic Conference/Summer School, Nonlinear Science and Complexity, Thessaloniki, Greece, July 12, 2006.
57. "Structural Testing at the Micro and Nano Scales," 3rd Workshop on Nanosciences and Nanotechnologies, Thessaloniki, Greece, July 10, 2006.
56. "Structural Testing at the Micro and Nano Scales," Department of Civil Engineering, University of Southern California, May 19, 2006.
55. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Civil Engineering, University of Minnesota, March 12, 2006.
54. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Mechanical Engineering and Materials Science, Rice University, December 12, 2005.
53. "Fracture and Fatigue of Silicon MEMS Structures," Gordon Conference Solid State Studies in Ceramics, July 18, 2005, Tilton School, New Hampshire.
52. "Breaking Invisible Specimens with Zero Force," Department of Structural and Geotechnical Engineering, Università di Genova, July 14, 2005.
51. "Toughening Mechanisms in Mollusk Shells," Laboratory of Mechanics, Ecole Polytechnique Federale de Lausanne, June 22, 2005.

50. "Composite Materials: Lessons from Nature," Department of Bioengineering, University of Toledo, Dec. 3, 2004.
49. "Breaking Invisible Specimens with Zero Force," Department of Structural Engineering, Politecnico di Milano, June 28, 2004.
48. "Breaking Invisible Specimens with Zero Force," Department of Structural Mechanics, Universita di Pisa, June 22, 2004.
47. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Structural Mechanics, Universita di Pisa, June 23, 2004.
46. "Breaking Invisible Specimens with Zero Force," Department of Mechanical Engineering, Northeastern University, January 23, 2003.
45. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Division of Engineering and Applied Science, Harvard University, December 3, 2003.
44. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Division of Engineering, Brown University, November 5, 2003.
43. "Breaking Invisible Specimens with Zero Force," Department of Mechanical and Environmental Engineering, U.C. Santa Barbara, January 13, 2003.
42. "Breaking Invisible Specimens with Zero Force," Department of Civil and Environmental Engineering, M.I.T., December 3, 2002.
41. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Aeronautics and Astronautics, M.I.T., April 3, 2002.

40. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Mechanical Engineering Department, Northwestern University, March 22, 2002.
39. "Crack Growth in Polysilicon MEMS Structures," Symposium on the Mechanical Properties of MEMS Structures, ASME Winter Annual Meeting, New York, November 11-16, 2001.
38. "Design of Multilayered Polysilicon fo MOEMS Applications," Symposium on the Mechanical Properties of MEMS Structures, ASME Winter Annual Meeting, New York, November 11-16, 2001.
37. "Fracture, Fatigue and Strength of MEMS Polysilicon and Silicon Carbide MEMS," Department of Mechanical and Aerospace Engineering, Ohio State University, October 12, 2001.
36. "The Effects of Grain Boundary Stiffness on the Size Effect in Cracked Polycrystalline Films," Symposium on Modeling and Simulation of Micro and Nano Systems, 6th U.S. National Congress on Computational Mechanics, Dearborn, Michigan, August 2, 2001.
35. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Civil Engineering Department, City College of New York, April 23, 2001.
34. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Olin College of Engineering, April 18, 2001
33. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Mechanical Engineering and Materials Science Department, Princeton University, October 27, 2000.
32. "Breaking Invisible Specimens with Zero Force" Mechanical Engineering and Materials Science Department, Rice University, February 28, 2000.
31. "Breaking Invisible Specimens with Zero Force" Civil and Environmental Engineering Department, Cornell University, November 7, 1999.
30. "Mechanics of MEMS," presented at the NSF Workshop on Nano and Micro-Mechanics of Solids for Emerging Science and Technology, Palo Alto, California, October 7-8, 1999.

29. "Electrostatically Actuated Failure of Microfabricated Polysilicon Fracture Mechanics Specimens," Texas Instruments Digital Imaging Group, Dallas, Texas, March 2, 1999.
28. "Recent Advances in Experimental and Theoretical Studies of the Mechanical Behavior of Polycrystalline Silicon for Microelectromechanical Systems," MRS 1998 Fall Meeting, Boston, Nov. 30-Dec.4, 1998.
27. "Theoretical and Experimental Studies on the Fracture Mechanics of Microelectromechanical Systems," Department of Engineering Mechanics, Ohio State University, October 6, 1998.
26. "Monte Carlo Study of the Role of Grain Structure on Crack-Tip Energy Release Rates in Polycrystalline Thin Films," Thirteenth U.S. National Congress of Applied Mechanics, University of Florida, June 21-26, 1998.
25. "On Fracture Toughness of Polycrystalline Silicon Microdevices," Department of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin, March 27, 1997.
24. "Failure Mechanisms of the *Strombus Gigas* Conch Shell," Istituto di Scienze delle Costruzioni, Universita di Pisa, Pisa, Italy, July 12, 1995.
23. "A Cohesive Zone Model for Cracks Terminating at a Bimaterial Interface," Division of Engineering and Applied Sciences, Harvard University, May 31, 1995.
22. "Back of the Envelope Fracture Mechanics," Department of Civil Engineering, University of Minnesota, April 29, 1995.
21. "Numerical and Analytical Modeling of Delamination Cracking in Brittle Matrix Composite Laminates," Istituto di Scienze delle Costruzioni, Universita di Pisa, Pisa, Italy, October 13, 1994.
20. "Near Tip Dual-Length Scale Mechanics of Mode-I Cracking in Laminate Brittle Matrix Composites," I.U.T.A.M. Symposium on Size Effects in the Failure Mechanisms of Materials and Structures, Politecnico di Torino, Italy, October 3-7, 1994.
19. "Fracture Mechanics Analyses of Anchor Bolts Embedded in Brittle Materials," Department of Civil Engineering, University of Minnesota, October 15, 1993.
18. "A Certain Mixed Boundary Value Problem for a Bimaterial Interface," Symposium in honor of Professor John Dundurs, U.S. National Congress of Theoretical and Applied Mechanics, Seattle, Washington, June 26-July 1, 1994.
17. "Numerical and Analytical Modeling of Delamination Cracking in Brittle Matrix Composite Laminates," School of Aeronautics and Astronautics, Purdue University, Nov. 19, 1992.
16. "Near-Tip Dual-Length Scale Mechanics of Mode-I Cracking in Laminate Brittle Matrix Composites," session entitled Ceramic Matrix Composites, Structural Dynamics and Materials Conference, Dallas, Texas, April 13-15, 1992.
15. "Fracture Mechanics Analyses of Anchor Bolts Embedded in Brittle Materials," Department of Engineering Mechanics, University of Kentucky (Lexington), June 20, 1991.
14. "Effects of Superposed Hydrostatic Stress on the Elastoplastic Behavior of Two-Phase Composites," session entitled Creep/Inelastic Behavior, ASME-AMD Symposium on the Mechanics of Composites at Elevated and Cryogenic Temperatures, Columbus, Ohio, June 11-19, 1991.
13. "Analysis of a CMC Compact Tension Specimen," session entitled Experimental and Computational Modelling of Composite Materials, ASCE Engineering Mechanics Specialty Conference, Columbus, Ohio, May 19-22, 1991.

12. "Stability Analysis of Bridged Cracks in Brittle Matrix Composites," session entitled Mechanics of Ceramic Matrix Composites, ASME International Gas Turbine and Aeroengine Congress and Exposition, Orlando, Florida, June 3-6, 1991.
11. "Dislocation Modeling of Cracks," Dipartimento di Costruzioni Meccaniche e Nucleari (Department of Mechanical and Nuclear Constructions), Universita di Pisa, Pisa, Italy, July 3, 1990.
10. "Fracture Mechanics Modeling of Short Anchor Bolts," Istituto di Scienze delle Costruzioni, Universita di Pisa, Pisa, Italy, June 12, 1990.
9. "Analytical Techniques for Elastostatics Problems Involving Bimaterial Interfaces," Department of Mechanical Engineering and Engineering Mechanics, Michigan Technological University, April 17, 1990.
8. "Finite Element Modeling of Frictionally Restrained Composite Interfaces," session entitled Interfaces in Metal-Ceramic Composites II: Modeling of Interfaces Properties, TMS Annual Meeting, Anaheim, California, February 18-22, 1990.
7. "Local-Global Analysis of Crack Growth in Continuously Reinforced Ceramic Matrix Composites," session entitled Computational Methods for Composites I: Micromechanics, 3rd Joint ASCE-ASME Mechanics Conference, University of California, San Diego, July 9-12, 1989.
6. "Local-Global Analysis of Crack Growth in Continuously Reinforced Ceramic Matrix Composites," session entitled Mechanics of Ceramic Matrix Composites, 34th ASME International Gas Turbine and Aeroengine Congress and Exposition, Toronto, Canada, June 5, 1989.
5. "Elastostatics Problems for a Bimaterial Interface," ICOMP Workshop on Dealing with Large Gradients in Computational Fluid and Structural Mechanics, NASA-Lewis Research Center, August 16, 1988.
4. "The Interaction Between a Crack and a Dislocation Dipole," Department of Metallurgy and Materials Science, Case Western Reserve University, March 25, 1988.
3. "The Pull-Out of Rigid Anchors - Theory and Experiment," Department of Mechanics and Materials Science, Rutgers University as part of their Fall 1987 seminar series, October 1, 1987.
2. "The Effects of Crack Surface Friction and Roughness on Crack Tip Stress Fields," session entitled Computational Approaches to Interface Behavior I, American Society of Civil Engineers Engineering Mechanics Division Specialty Conference in Buffalo, New York, May 20-22, 1987.
1. "Interesting Crack Problems," Fracture and Fatigue section of NASA-Lewis Research Center, July 15, 1986.

Selected Grants During Past Decade

NSF "A Multiscale Reliability Model for Brittle MEMS Materials and Structures" (with J. Le and E. Tadmor, University of Minnesota).

NSF "Nanomechanical Characterizations of Interfaces in Carbon Nanotube Reinforced Nanocomposites" (with J. Lou and B. Yakobson, Rice University).

NIH "Single Fibril Mechanics" (with S. Eppell, CWRU).

NSF "SGER: Damage Investigation and Data Collection for Collapsed I-35W Bridge ."

NSF “NIRT-Novel Experiments and Models for the Nanomechanics of Polymeric and Collagenic Nanofibers” (with University of Illinois and University of Virginia).

NSF “Bioinspired MEMS Composites.”

DARPA “Reliability of MEMS Materials” (with A. Heuer, CWRU)

Student Supervision:

Current Graduate Students

Seyedeh Hanie Seyed Joodat, Department of Civil and Environmental Engineering

Thesis: Theoretical and Computational Modeling of the Effects of Dual-Scale Porosity in Hydraulic Fracture (started 9/15)

Davide Giannuzzi, Department of Civil Engineering (Ph.D.; expected 12/15)

Thesis: Braced Ductile Shear Panel: a New Seismic Resistant Framing System

Graduated Students

Igor Ostanin, Ph.D 2014 Department of Civil Engineering

Thesis: Multiscale modeling of carbon nanotube materials with distinct element method.

Minmao Liao, Ph.D. 2011 Department of Civil Engineering

Thesis: Towards Fracture Mechanics-Based Design Approach for Unbonded Concrete Overlay Pavements

Lucas Hale, Ph.D. 2011 Department of Chemical Engineering and Materials Science

Thesis: Hardening Mechanisms of Silicon Nanospheres: A Molecular Dynamics Study

Roberto Piccinin, Ph.D 2010 Department of Civil Engineering

Thesis: Effects of Compressive and Tensile Fields on the Load Carrying Capacity of Headed Anchors

Zhilei (Julie) Shen , Ph.D. 2010 Department of Biomedical Engineering

Thesis: Tensile Mechanical Properties of Isolated Collagen Fibrils Obtained by Micro-Electromechanical Systems Technology

Li Chen, Ph.D. 2005

Thesis: A Bioinspired Micro-Composite

Yuping Wang, Ph.D. 2003

Thesis: Crack-Tip Parameters in Polycrystalline Plates with Compliant Grain Boundaries

Shekhar Kamat, Ph.D. 2000

Thesis: Toughening Mechanisms in Laminated Composites: A Biomimetic Study in Mollusk Shells

Ramazan Kayacan, Ph.D. 1997

Thesis: Structural Mechanics of Implant Supported Partial Dental Prostheses

Alberto Romeo, Ph.D. 1995

Thesis: On a Crack Tip Interacting with a Bimaterial Interface

David Lewicki, Ph.D. 1995

Thesis: Analytical and Experimental Analysis of Fatigue Crack Propagation in Helicopter Gears

- Zhiren Zhu, M.S. 2015
A Probabilistic Model for Failure of Polycrystalline Silicon MEMS Structures
- M. Liao, M.S. 2009
Thesis: A Computational Study of the I-35W Bridge Failure
- Aiqing Ni, M.S. 2002
Thesis: Optimum Design of Multi-Polysilicon Films for Prescribed Curvature
- Maissarath Nassirou, M.S. 2001
Thesis: Characterization of the Damage Mechanisms and Environmental Effects on the Mechanical Properties of the Shell of Strombus Gigas
- Nouredding Tayebi, M.S. 2000
Thesis: Fracture Toughness of Polysilicon MEMS Devices
- Li Chen, M.S. 2000
Thesis: Crack Propagation in a Material with Random Toughness
- Zhao Yang Chu, M.S. 2000
Thesis: Monte Carlo Simulation of Elastic Properties of Polycrystalline Materials Using the Johnson-Mehl Model
- Todd Cooper, M.S. 1999
Thesis: Size Effects (Macro- and Micro-Scale) on the Fracture Toughness Behavior of High Strength Concrete
- Brian Thornton, M.S. 1999
Thesis: Mechanochromic Behavior of Diacetylene Polymers
- Brandinelli, Luigi, M.S. 1997 (Fulbright Fellow)
Thesis: Fracture Mechanics of Polycrystalline Silicon Microdevices
- Anadutula, Rao, M.S. 1997
Thesis: Retrofitting Cracked Steel Bridges with Adhesively Bonded Plates
- Yin, Yumin, M.S. 1997
Thesis: Mechanical Properties of Polysilicon for Microelectromechanical Systems
- Marty Bixler, M.S. 1996
Project: Retrofitting Fatigue-Distressed Steel Bridges with Adhesively Bonded Plates
- Bartlett, Eric, M.S. 1994
Project: Fatigue Analysis of an Integral Sheet Metal Attachment to a Forged Fluid Tube Housing
- Ferrante, Gary, M.S. 1993
Thesis: An Analysis of Reflection Cracking Through Fracture Mechanics
- Bar-Lev, Noam, M.S. 1993
Thesis: Application of Fracture Mechanics to Damage Tolerance Analysis and Design of Aircraft Engine Mounts
- Gultop, Sukru, M.S. 1993
Thesis: The Effects of Superimposed Hydrostatic Pressure on the Mechanical Response of an Idealized Metal Matrix Composite
- Petersson, Joakim, M.S. 1992
Thesis: An Analysis of a Viscoelastic Road subjected to Tension and Heating
- Islam, Sanjib, M.S. 1992
Thesis: Near-Tip Dual-Length Scale Mechanics of Mode-I Cracking in Laminate Brittle Matrix Composites
- Genin, Guy, M.S. 1991

Thesis: The Effects of Superimposed Hydrostatic Pressure on Deformation in an Idealized Metal Matrix Composite
Ozgur, Mehmet, M.S. 1991
Thesis: Boundary Element Modeling of Frictional Interfaces
Sandeep Muju, M.S. 1991
Thesis: Stability Analysis of Bridged Cracks in Brittle Matrix Composites
Yingchun Hsu, M.S. 1989
Thesis: Three-Dimensional Analysis of Surface Crack - Hertzian Stress Field Interaction
Sk. Shamim Ahmed, M.S. 1989
Thesis: Local-Global Analysis of Crack Growth in Continuously Reinforced Ceramic Matrix Composites

Post-Docs/Visiting Professors, Scholars and Students

Evgeniya Dontsova, 9/15-present
Sara Adibi, 4/15-present
Alessia Monaco, Universita di Palermo, 8/13-12/13
Francesco Conigliaro, Universita di Palermo, 9/13-11/13
Martina Greco, Universita di Palermo, 9/13-11/13
Giovanni Schicchi, Universita di Palermo, 9/13-11/13
Annalisa Franco, University of Pisa, 3/13-8/13
Mathieu Pieuchot, Ecole Polytechnique, 3/12-5/12
Dr. Yuye Tang (2008-2010)
Dr. M. Bialas, Institute of Fundamental Technological Research, Poland (2009-2010)
Prof. Ramazan Kayacan, Suleyman Demirel University, Turkey (2001-2002)
Prof. Dov Sherman, Technion, Israel (2000-2001)
Hal Kahn (1995-2002)
Hannes Kessler, University of Dresden (1994-1995)
Haian Luo (1989-1991)
Qingyuan Meng (1992-1993)
Tian, T.Z. (1993-1994)

Consulting

Nestle Research and Development; City of Cleveland; Wright Patterson Air Force Base; Garson and Associates; Spangenberg, Shibley and Liber; Alcatel; General Electric Company; Alcoa; Fiber Materials, Inc.; Teltech; Fracture Analysis Consultants; Nurenberg, Plevin, Heller and McCarthy.