

## Curriculum Vitae

**Name:** **Roberto Ballarini, Ph.D., P.E., F.E.M.I, Dist.M.ASCE**  
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:**

6/21-present **University of Houston**  
Director, University of Houston-Dalian Maritime University Institute  
Thomas and Laura Hsu Professor and Chair, Department of Civil and Environmental Engineering

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***

Tongji University (numerous visits, 2017-2019), Dalian Maritime University (numerous visits, 2017-2019), University of Genova (numerous visits, 1995-2016), Polytechnic of Madrid (6/14), Tsinghua University (numerous visits, 2013-2019), University of Palermo (5/13), National Taiwan University (numerous visits, 2006-2019), University of Minnesota (3/06, 2/95-5/95), University of Pisa (numerous visits, 1990-2005), Politecnico di Torino (5/90-7/90)

### **Selected Honors and Awards:**

ASCE Distinguished Member, 2021  
2019 Raymond D. Mindlin Medal (ASCE Engineering Mechanics Institute)  
High-Eng Foreign Expert, Tongji University, 2018-2020  
Chair Professor, Dalian Maritime University, 2017-2019  
Inaugural Fellow, ASCE Engineering Mechanics Institute, 2013  
President, ASCE Engineering Mechanics Institute, 1/13-10/15  
ASCE Fellow, 11/07  
John S. Diekhoff Award for Distinguished Graduate Teaching, CWRU, 2000

### **Editorial Activities**

Editor-in-Chief, ASCE Journal of Engineering Mechanics (2012-2021)  
Associate Editor, Meccanica (2016-2021)  
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 more than 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 multiscale-time-dependent progressive collapse of reinforced concrete structures, stochastic modeling of the effects of imperfections on buckling of plates and shells, bioinspired design of damage tolerant composites, reliability of microelectromechanical systems (MEMS) devices, structural testing of nanoscale biological and synthetic materials such as collagen fibrils, carbon nanotubes and MEMS materials, computational materials science, multiscale modeling of heterogeneous materials, the design and testing of a new earthquake

energy dissipation system for steel structures, size effects in quasibrittle materials, statistical strength distributions in glass and other types of ceramics.

## **Publications:**

### ***Selected Journal Publications (complete citation in complete list of publications):***

“Structural Basis for the Fracture Toughness of the Shell of the Conch *Strombus Gigas*, *Nature*, Vol. 405, June 29, pp. 1036-1040, 2000.

“Fatigue Failure in Polysilicon Not Due to Simple Stress Corrosion,” *Science*, Vol. 298, pp. 1215-1219, Nov. 8, 2002.

“Electrostatically Actuated Failure of Microfabricated Polysilicon Fracture Mechanics Specimens,” *Proceedings of the Royal Society of London*, A455, pp. 3807-3823, 1999.

“A Newtonian Interpretation of Configurational Forces on Dislocations and Cracks,” *Journal of the Mechanics and Physics of Solids*, Vol. 95, pp. 602-620, October 2016.

“Stress-strain Experiments on Individual Collagen Fibrils,” *Biophysical Journal*, Vol. 95, 2008, 3956-3963.

“Coupled Quantum Mechanical/Molecular Mechanical Modeling of the Fracture of Defective Carbon Nanotubes and Graphene Sheets,” *Physical Review B* 75, 1 2007.

"Failure Characteristics of Short Anchor Bolts Embedded in a Brittle Material," *Proceedings of the Royal Society of London*, A404, pp. 35-54, 1986.

### ***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; Complete List***

**122.** D. Giannuzzi, R. Ballarini and A. Huckelbridge, “Experimental Investigation of the Cyclic Performance of the Braced Ductile Shear Panel (BDSP) Bracing system,” to be submitted.

**121.** X. Ren, X. Wei and R. Ballarini, “A Temporal Multi-Scale Model for Fatigue Damage of Concrete,” *ASCE Journal of Engineering Mechanics*, in press.

**120.** A. Bessmertnykh, E. Dontsov and R. Ballarini, “Semi-Infinite Hydraulic Fracture Driven by a Sequence of Power Law Fluids,” *ASCE Journal of Engineering Mechanics*, Vol. 47, Issue 10, Article Number 04021064, October 1, 2021, DOI: 10.1061/(ASCE)EM.1943-7889.0001958.

**119.** I. Protasov, E. Dontsov and R. Ballarini, “Enhanced Pseudo-Three-Dimensional Model for Multiple Hydraulic Fractures,” *Journal of Applied Mechanics-Transactions of the ASME*, Vol. 88, Issue 1, Article Number 011003, January 2021, DOI: 10.1115/1.4048375.

**118.** E. Dontsova, B.I. Yakobson and R. Ballarini, “Dimensionality Effects in Crystal Plasticity, from 3D Silicon to 2D silicene?”, *Extreme Mechanics Letters*, Vol. 40, Article Number 100892, October 2020, DOI: 10.1016/j.eml.2020.100892.

**117.** L. Mello. R. Ballarini and J. Le, “Numerical Modeling of Delayed Progressive Collapse of Reinforced Concrete Structures,” *ASCE Journal of Engineering Mechanics*, Vol. 146, Issue 10, Article Number 04020113, October 1, 2020, DOI: 10.1061/(ASCE)EM.1943-7889.0001843.

**116.** Q. Wang, X. Ren and R. Ballarini, “A Multifield Model for Early-Age Massive Concrete Structures: Hydration, Damage and Creep,” *ASCE Journal of Engineering Mechanics*, Vol. 146, Issue 10, Article Number 04020115, DOI: 10.1061/(ASCE)EM.1943-7889.0001851.

**115.** A. Bessmertnykh, E. Dontsov and R. Ballarini, “The Effects of Proppant on the Near-Front Behavior of a Hydraulic Fracture,” *Engineering Fracture Mechanics*, Vol. 235, August 2020, 107110.

**114.** V. Diana and R. Ballarini, “Crack Kinking in Isotropic and Orthotropic Micropolar Peridynamic Solids,” *International Journal of Solids and Structures*, Volumes 196-197, July 2020, Pages 76-98.

**113.** X. Ren, Q. Wang, R. Ballarini and X. Gao, “Coupled Creep-Damage-Plasticity Model for Concrete under Long Term Loading,” *ASCE Journal of Engineering Mechanics*, 2020, 146(5): 04020027.

**112.** P. Saez, S.J. Eppell, R. Ballarini and F. Rodriguez Matas, “A Complementary Approach Accommodates Scale Differences in Soft Tissues,” *Journal of the Mechanics and Physics of Solids*, Vol. 138, Article 103895, May 2020.

**111.** Z. Hu, R. Ballarini and J. Le, “A Renewal Weakest-Link Model of Strength Distribution of Polycrystalline Silicon MEMS Structures,” *Journal of Applied Mechanics of the ASME*, Vol. 86, Issue 8, Article Number 081005, August 2019.

**110.** R. Ballarini, V. Diana, L. Biolzi and S. Casolo, “Bond-Based Peridynamic Modelling of Singular and Nonsingular Crack-Tip Fields,” *Meccanica*, Vol. 53, Issue 14, pp. 3495-3515, November 2018.

**109.** K.B. Nakshatrala, S.H.S. Joodat, and R. Ballarini, “Modeling Flow in Porous Media with Double Porosity/Permeability: Mathematical Model, Properties, and Analytical Solutions,” *ASME Journal of Applied Mechanics*, Vol. 85, Issue 8, Article No. 081009, August 2018.

**108.** S.H.S. Joodat, K.B. Nakshatrala, and R. Ballarini, “Modeling Flow in Porous Media with Double Porosity/Permeability: A Stabilized Mixed Formulation, Error Analysis and Numerical Solutions,” *Computer Methods in Applied Mechanics and Engineering*, Vol. 337, pp. 632-676, August 1, 2018.

- 107.** W. Gerberich, E.B. Tadmor, J. Kysar, J.A. Zimmerman, A.M. Minor, I. Szlufarska, J. Amodeo, B. Devincere, E. Hintsala, and R. Ballarini, "Review Article: Case Studies in Future Trends of Computational and Experimental Nanomechanics," *Journal of Vacuum Science and Technology A: Vacuum, Surfaces, and Films*, 35, 060801 (2017).
- 106.** E. Dontsova and R. Ballarini, "Atomistic Modeling of the Fracture Toughness of Silicon and Silicon-Silicon Interfaces," *International Journal of Fracture*, Vol. 207, Issue 1, pp. 99-122, Sept. 2017.
- 105.** R. Ballarini and Y. Xie, "Fracture Mechanics Formula for Load-Carrying Capacity of Group Anchors," *ASCE Journal of Engineering Mechanics*, DOI: 10.1061/(ASCE)EM.1943-7889.0001200.
- 104.** R. Ballarini, L. La Mendola, J. Le, A. Monaco, "Computational Study of Failure of Hybrid Steel Trussed Concrete Beams," *ASCE Journal of Structural Engineering*, Vol. 143, Issue 8, Article 04017060, August 2017.
- 103.** E.D. Hintsala, S. Bhowmick, Y.Y. Xue, R. Ballarini, S.A.S. Asif and W.W. Gerberich, "Temperature Dependent Fracture Initiation in Microscale Silicon," *Scripta Materialia*, Vol. 130, pp. 78-82, March 15, 2017.
- 102.** R. Ballarini, G. Pisano and G. Royer-Carfagni, "The Lower Bound for Glass Strength and its Interpretation with Generalized Weibull Statistics for Structural Applications," *ASCE Journal of Engineering Mechanics*, Vol. 142, Article Number 04016100, Dec. 2016.
- 101.** R. Ballarini and G. Royer-Carfagni, "A Newtonian Interpretation of Configurational Forces on Dislocations and Cracks," *Journal of the Mechanics and Physics of Solids*, Vol. 95, pp. 602-620, October 2016.
- 100.** Y. Liu, R. Ballarini and S.J. Eppell, "Tension Tests on Mammalian Collagen Fibrils," *Interface Focus* Vol. 6, Issue: 1, Article: 20150080, February 6, 2016.
- 99.** 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," *Construction and Building Materials* 121, pp. 69-80, 2016.
- 98.** R. Ballarini and G. Royer-Carfagni, "Closed-Path J-Integral Analysis of Bridged and Phase-Field Cracks," *ASME Journal of Applied Mechanics*, Vol. 83, 061008-2, 2016.
- 97.** S. Adibi, P.S. Branicio and R. Ballarini, "Compromising High Strength and Ductility in Nanoglass-metallic Glass Nanolaminates," *Royal Society of Chemistry Advances*, Vol. 6, Issue: 16, 13548-13553, 2016.
- 96.** W.W. Gerberich, R. Ballarini, E.D. Hintsala, M. Mishra, J-F Molinari and I. Szlufarska, "Toward Demystifying the Mohs Hardness Scale," 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 Visco-elastic 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. Mogilevskaya, 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).
63. H. Kahn, A. Avishai, R. Ballarini and A.H. Heuer, "Surface oxide effects on failure of polysilicon MEMS after cyclic and monotonic loading," *Scripta Materialia*, Vol. 59, Issue 9, 2008, 912-915.
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.
60. R. Khare, S.L. Mielke, J.T. Paci, S. Zhang, R. Ballarini, G.C. Schatz and T. Belytschko, "Coupled Quantum Mechanical/Molecular Mechanical Modeling of the Fracture of Defective Carbon Nanotubes and Graphene Sheets," *Physical Review B* 75, 1 2007.
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.
57. V. Hatty, H. Kahn, J. Trevino, M. Mehregany, C.A. Zorman, R. Ballarini, A.H. Heuer, "Fracture Toughness of LPCVD Polycrystalline Silicon Carbide Thin Films," *Journal of Applied Physics*, Vol. 99, 013517, 2006.
56. S. Eppell, B. Smith, H. Kahn and R. Ballarini, "Nano Measurements With Micro Devices: Mechanical Properties of Hydrated Collagen Fibrils," *Journal of the Royal Society Interface*, Vol. 3, pp. 117-121, 2006.
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.
49. S. Kamat, H. Kessler, R. Ballarini, A.H. Heuer, "Fracture mechanisms of the *Strombus gigas* conch shell: II Micromechanics analyses of multiple cracking and large scale crack bridging," *Acta Materialia*, Vol. 52, pp. 2395-2406, 2004.
48. H. Kahn, R. Ballarini and A.H. Heuer, "Dynamic Fatigue of Silicon," *Current Opinion in Solid State and Materials Science*, Vol. 8, pp. 71-76, 2004.
47. A. Ni, D. Sherman, R. Ballarini, H. Kahn, B. Mi, S.M. Phillips and A.H. Heuer, "Optimal Design of Multilayered Polysilicon Films for Prescribed Curvature," *Journal of Materials Science*, Vol. 38 (special issue Mechanical Properties of MEMS Structures), pp. 4169-4173, 2003.
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.
45. H. Kahn, R. Ballarini, J. Bellante and A.H. Heuer, "Fatigue Failure in Polysilicon Not Due to Simple Stress Corrosion," *Science*, Vol. 298, pp. 1215-1219, Nov. 8, 2002.
44. H. Kahn, R. Ballarini and A.H. Heuer, "Thermal Expansion of LPCVD Polysilicon," *Journal of Materials Research*, Vol. 17, No. 7, pp. 1855-1862, 2002.
43. Z.P. Bazant, Y.D.S. Rajapakse, D.H. Allen, R. Ballarini, H.D. Espinosa, H. Gao, R. Gettu, M. Jirasek, G. Pijaudier-Cabot, J. Planas and F.J. Ulm, "Report on ONR Workshop on Fracture Scaling," *International Journal of Fracture*, Vol. 113, pp. 345-366, 2002.



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### ***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.
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## Invited and Named Seminars

Raymond D. Mindlin Lecture, Department of Civil Engineering and Engineering Mechanics, Columbia University, October 8, 2019.

Distinguished Seminar Series on Recent Breakthroughs in Engineering Fields, Faculty of Engineering, Chongqing University, January 9, 2020.

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

136. "Fracture Mechanics Design of Anchor Bolts: Progress and Future Needs," Shaoxing International Forum on Digital Environment: Optimization and Innovation on Engineering Structures, November 19, 2021, Shaoxing University, China.

135. "Reverse Engineering of the Shells of Mollusks: an Example of Bioinspired Design," presented to School of Aeronautics and Astronautics, Chongqing University, January 9, 2020.

134. "Structural Testing at the Micro and Nano Scales," presented to School of Civil Engineering, Chongqing University, December 30, 2019.

133. "Fracture Mechanics Design in Civil and Mechanical Engineering: Two High Impact Applications," presented to School of Civil Engineering, Chongqing University, December 30, 2019.

132. "Fracture Mechanics Design in Civil and Mechanical Engineering: Two High Impact Applications," presented to Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, December 2, 2019.

131. "Are Configurational Forces Real Forces," presented to Department of Civil Engineering and Engineering Mechanics, Columbia University, October 8, 2019.

130. 129. "Fracture Mechanics Design in Civil and Mechanical Engineering: Two High Impact Applications," presented to School of Mechanical Engineering and Automation, Beihang University, September 20, 2019.

128. "Are Configurational Forces Real Forces," presented to Department of Aerospace Engineering and Mechanics, Tsinghua University, Civil Engineering and Mechanics, Columbia University, May 24, 2019.

127. "Reverse Engineering of Biological Structures," presented to University of Florence, March 11, 2019.

126. "Reverse Engineering of Biological Structures," presented to the Materials Science group at City University of Hong Kong, January 7, 2019.

125. "Are Configurational Forces Real?," presented to the Institute of Applied Mechanics at National Taiwan University, January 3, 2019.

124. "Fracture Mechanics Design of Anchor Bolts: Advances and Challenges," presented to the National Center for Research on Earthquake Engineering, Taipei, January 2, 2019.

123. "Structural Testing at the Micro and Nano Scales," presented to the Department of Civil and Urban Engineering, New York University, December 2, 2018.

122. "Reverse Engineering of Biological Structures," presented to the Mechanical Engineering Department at University of Pittsburgh, September 20, 2018.

121. "Reverse Engineering of Biological Structures," presented to the Mechanics group at Shanghai Jiatong University, November 9, 2018.

120. "Distributed Damage Causes Flaw Tolerance," presented to the Structural Engineering group at Tongji University, June 22, 2018.

119. “Reverse Engineering of Biological Structures,” presented to the Structural Engineering group of Tongji University,” June 12, 2018.
118. “Fracture Mechanics-Based Design,” presented to the Structural Engineering group of Tongji University, June 14, 2018.
117. “Structural Testing at the Micro and Nano Scales,” presented to the Department of Civil and Environmental Engineering, Carnegie Mellon University, November 3, 2017.
116. “Fracture Mechanics-Based Design of Anchor Bolts,” presented at the Symposium to Honor Zdenek Bazant for his 80<sup>th</sup> Birthday, ASCE EMI Conference, June 5, 2017.
115. “Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force,” presented the Wenyuan Seminar at the Department of Structural Engineering, Tongji University, April 2, 2017.
114. “Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force,” presented to the Solid and Structural Mechanics Group at University of Trento, July 20, 2016.
113. “Atomistic Modeling of Fracture in Silicon and Silicon-Silicon Interfaces,” presented to the Department of Industrial Engineering, University of Parma, July 7, 2016.
112. “The Collapse of the I-35W Bridge in Minneapolis,” presented to the Dipartimento di Ingegneria delle Costruzioni, dell’Ambiente e del Territorio, University of Genova, May 11, 2016.
111. “Reverse Engineering of the Shells of Mollusks: An Example of Bioinspired Design in an Inspired Research Environment,” presented to Technical University of Vienna as part of their Vision 2025 initiative, May 2, 2016.
110. “Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force,” keynote lecture at International Conference on Plasticity, Kona, Hawaii, January 6, 2016.
109. “Reverse Engineering of Biological Structures,” presented to Department of Mechanical Engineering, M.I.T., 12/1/15.
108. “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.
107. “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.
106. “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.
105. “Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force,” Keynote Lecture at ASME 2015 4<sup>th</sup> Global Conference on Nanoengineering for Medicine and Biology, Minneapolis, April 19-22, 2015.
104. “Structural Testing at the Micro and Nano Scales: Breaking Invisible Specimens with Zero Force,” Houston Methodist Research Institute, January 14, 2015.
103. “Reverse Engineering of Biological Structures,” Hong Kong Polytechnic University, January 6, 2015.
102. “Structural Testing at the Micro and Nano Scales,” Public Lecture organized by Hong Kong Polytechnic University, January 5, 2015.
101. “Testing Collagen Fibrils Using MEMS Platforms,” 7<sup>th</sup> World Congress of Biomechanics,” Boston, MA, July 9, 2014.
100. “Reverse Engineering of Biological Structures,” Department of Materials Science, Universidad Politécnica de Madrid, June 18, 2014.

99. "Structural Testing at the Micro and Nano Scales," Department of Materials Science, Universidad Politécnica de Madrid, June 17, 2014.
98. "Structural Testing at the Micro and Nano Scales," Department of Civil and Environmental Engineering, Georgia Institute of Technology,, June 19, 2014.
97. "Structural Testing at the Micro and Nano Scales," Department of Civil and Environmental Engineering, University of Houston, March 17, 2014
96. "Breaking Invisible Specimens with Zero Force," Department of Engineering Mechanics, Tsinghua University, Beijing, China, June 14, 2013.
95. "Effects of Stress Singularities on Scaling of Quasibrittle Fracture," the 13th International Conference on Fracture, June 16-21, 2013, Beijing.
94. "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.
93. "Distributed Damage Creates Flaw Tolerance," the 13th International Conference on Fracture, June 16-21, 2013, Beijing.
92. "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.
91. "Breaking Invisible Specimens with Zero Force," presented to the Department of Mechanical Engineering, Boston University, February 1, 2013.
90. "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.
89. "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.
88. "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.
87. "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.
86. "An Academic Investigation of the I-35W Bridge Collapse," Luminary Session Invited Talk, Prognostic Health Management Society Conference 2012, Minneapolis, Minnesota, September 26, 2012.
85. "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.
84. "Structural Testing at the Micro and Nano Scales," Department of Mechanical Engineering, Tufts University, April 19, 2012.
83. "Structural Testing at the Micro and Nano Scales," Biointerest Group, University of Illinois at Urbana-Champaign, October 20, 2011.
82. "Mechanical Testing and Computational Modeling of Individual Collagen Fibrils," Society of Engineering Science 2011 Technical Meeting, Northwestern University, October 12, 2011.
81. "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.
80. "Cracking the Conch Conundrum: Tough Ceramics at the Seashore," presented to the Department of Civil Engineering at University of South Carolina, February 11, 2011.

79. "Collagen Fibrils: Experiments and Computational Modeling," Special Structures Seminar, Department of Civil Engineering, Northwestern University," July 8, 2010.
78. "Reverse Engineering of Biological Structures," Keynote Lecture, 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials, Virginia Tech, June 26, 2009.
77. "Cracking the Conch Conundrum: Tough Ceramics at the Seashore," presented to the Department of Civil Engineering at Columbia University, March 24, 2009.
76. "Structural Testing at the Micro and Nano Scales," presented to the Department of Civil Engineering at City College of New York, March 19, 2009.
75. "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.
74. "Breaking Invisible Specimens with Zero Force," Sandia National Laboratories, Albuquerque, New Mexico, 3/31/08.
73. "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.
72. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Café Scientifique, 12/11/07.
71. "Structural Fatigue in our Nation's Transportation Infrastructure," Oberstar Forum on Infrastructure, 10/8/07.
70. "Biological Structures Mitigate Catastrophic Fracture through Various Strategies," Department of Aerospace and Mechanics, University of Texas at Austin, 9/28/07.
69. 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.
68. "Tensile Testing of Collagen Fibril Using a MEMS Platform," 9<sup>th</sup> U.S. National Congress on Computational Mechanics, San Francisco, 7/25/07.
67. "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.
66. "Biological Structures Mitigate Catastrophic Fracture through Various Strategies," Department of Civil Engineering, M.I.T., 4/3/07.
65. "Bioinspired Design of Composite Materials," Department of Civil Engineering, Tufts University, 4/2/07.
64. "Structural Testing at the Micro and Nano Scales," Department of Aerospace Engineering and Mechanics, University of Minnesota, Dec. 1, 2006.
63. "Structural Testing at the Micro and Nano Scales," Department of Civil Engineering, University of Thessaly, Greece, July 20, 2006.
62. "Fracture Mechanics of Mollusks Shells," Department of Civil Engineering, University of Thessaly, Greece, July 20, 2006.
61. "Biological Structures Mitigate Catastrophic Fracture Through Various Strategies," 19<sup>th</sup> Panhellenic Conference/Summer School, Nonlinear Science and Complexity, Thessaloniki, Greece, July 12, 2006.
60. "Structural Testing at the Micro and Nano Scales," 3<sup>rd</sup> Workshop on Nanosciences and Nanotechnologies, Thessaloniki, Greece, July 10, 2006.
59. "Structural Testing at the Micro and Nano Scales," Department of Civil Engineering, University of Southern California, May 19, 2006.
58. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Construction Engineering, National Taiwan University of Science and Technology, April 27, 2006.
57. "Structural Testing at the Micro and Nano Scales," Institute of Applied Mechanics, National Taiwan University, April 26, 2006.



56. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Institute of Applied Mechanics, National Taiwan University, April 25, 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, Università di Pisa, June 22, 2004.
47. "Cracking the Conch Conundrum; Tough Ceramics at the Seashore," Department of Structural Mechanics, Università 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 for 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, 6<sup>th</sup> 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.

### **Representative Grants**

DOE "Multiple Degradation Mechanisms in Reinforced Concrete Structures; Modeling and Risk Analysis" (with B. Gencturk and K. Willam)

DOE “Cask Mis-Loads Evaluation Techniques” (with B. Gencturk and K. Willam)

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

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

NIH “Single Fibril Mechanics” (with S. Eppell of 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 Ioannis Chasiotis of University of Illinois and University of Virginia).

NSF “Bioinspired MEMS Composites.”

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

### **Student Supervision:**

#### ***Current Graduate Students***

Zheren Baizhikova, started Ph.D. in Fall 2021, “Stochastic Modeling of the Effects of Imperfections on the Buckling Behavior of Plates and Shells”

#### ***Graduated Ph.D. Students (16)***

Livia Costa-Mello, Ph.D. 2020, Dep’t of Civil and Env. Eng., University of Houston  
Thesis: Computational Modeling of Delayed Progressive Collapse of Reinforced Concrete Building Structures

Ken Protasov, Ph.D. 2020, Dep’t of Civil and Env. Eng., University of Houston.  
Thesis: Accelerating Computations for Oil and Gas Problems: Reduced Physical Modeling of Hydraulic Fracturing and High Performance Computing for Fluid Flow in a Porous Medium

Alena Bessmertnykh, Ph.D. 2020, Dep’t of Civil and Env. Eng., University of Houston  
Thesis: The effects of Proppant, Complex Fluid Rheology and Rock Anisotropy on the Near-Front Behavior of a Hydraulic Fracture

Seyedeh Hanie Seyed Joodat, Ph.D. 2018, Dep’t of Civil and Env. Eng., University of Houston  
Thesis: Theoretical and Computational Modeling Study of Flow Through Porous Media with Double Porosity/Permeability.

Davide Giannuzzi, Ph.D. 2016, Dep’t of Civil, Env. and Geo Eng., University of Minnesota  
Thesis: Braced Ductile Shear Panel: a New Seismic Resistant Framing System

Igor Ostanin, Ph.D 2014, Department of Civil Engineering, University of Minnesota

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

Minmao Liao, Ph.D. 2011, Department of Civil Engineering, University of Minnesota  
Thesis: Towards Fracture Mechanics-Based Design Approach for Unbonded Concrete Overlay Pavements

Lucas Hale, Ph.D. 2011, Department of Chemical Engineering and Materials Science, University of Minnesota  
Thesis: Hardening Mechanisms of Silicon Nanospheres: A Molecular Dynamics Study

Roberto Piccinin, Ph.D. 2010, Department of Civil Engineering, University of Minnesota  
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, CWRU  
Thesis: Tensile Mechanical Properties of Isolated Collagen Fibrils Obtained by Micro-Electromechanical Systems Technology

Li Chen, Ph.D. 2005, Department of Civil Engineering, CWRU  
Thesis: A Bioinspired Micro-Composite

Yuping Wang, Ph.D. 2003, Department of Civil Engineering, CWRU  
Thesis: Crack-Tip Parameters in Polycrystalline Plates with Compliant Grain Boundaries

Shekhar Kamat, Ph.D. 2000, Department of Materials Science and Engineering, CWRU  
Thesis: Toughening Mechanisms in Laminated Composites: A Biomimetic Study in Mollusk Shells

Ramazan Kayacan, Ph.D. 1997, Department of Mechanical Engineering, CWRU  
Thesis: Structural Mechanics of Implant Supported Partial Dental Prostheses

Alberto Romeo, Ph.D. 1995, Department of Civil Engineering, CWRU  
Thesis: On a Crack Tip Interacting with a Bimaterial Interface

David Lewicki, Ph.D. 1995, Department of Mechanical Engineering, CWRU  
Thesis: Analytical and Experimental Analysis of Fatigue Crack Propagation in Helicopter Gears

### ***Graduated M.S. Students (24)***

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

Vito Diana, Politecnico di Milano, 2017, 2019.

Evgeniya Dontsova, 9/15-9/17

Dr. Gianni Royer-Carfagni, Universita di Parma, 10/15-5/16

Sara Adibi, 4/15-5/16

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.