Curriculum Vitae

Name:	**Roberto Ballarini, Ph.D., P.E., F. ASME, F.EMI, 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:

9/14-present	**University of Houston** Thomas and Laura Hsu Professor and Chair, Department of Civil and Environmental Engineering **Director, University of Houston-Dalian Maritime University Institute (2021-present)**
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
Stanford University (8/22-12/22), Tongji University (2018-2022), Dalian Maritime University (2017-2019), University of Genova (4/16), Polytechnic of Madrid (6/14), Tsinghua University (Beijing) (6/13), University of Palermo (5/13), National Taiwan University (3/06), 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:
Stanford University Shimizu Visiting Professor of Civil and Environmental Engineering, Fall 2022.
ASME Fellow, 2022.
University of Houston Global Faculty Award, 2022
Distinguished Member, American Society of Civil Engineers (ASCE), 2021.
2019 Raymond D. Mindlin Medal (ASCE Engineering Mechanics Institute)
High-End Foreign Expert, Tongji University, 2018-2022
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 ('16-'21)
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)

SIGNIFICANT ENGINEERING ACCOMPLISHMENTS

Engineering Research

Professor Ballarini's 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. He is particularly interested in characterizing the mechanics of fatigue and fracture. His 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. Ballarini made seminal contributions to fracture mechanics-based design of civil engineering structures; the use of microelectromechanical systems devices as platforms for testing the mechanical properties of micrometer and nanometer scale structures; bioinspired design of composite structures through the reverse engineering of the shells of mollusks; pioneering of discrete crack propagation-based design of spur gears used in aeronautical vehicles; stress analysis of cracks in heterogenous materials; and probabilistic models of the strength distributions of brittle materials. He has published more than 120 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*.

Engineering Education, Academic Leadership and Professional Service

Professor Ballarini has made significant contributions in teaching, as an individual and as an administrator. He has always received excellent student evaluations in his undergraduate and graduate courses, including the travel-abroad course ***Ancient and Modern Structures in Italy*** which Ballarini created while he was on the faculty at University of Minnesota. This course involved traveling for three weeks through Italy with 25-26 undergraduate students from across the University. The holistic syllabus included the mechanics of materials and structures, architecture, culture, art, and political issues associated with construction of iconic ancient and modern structures.

Ballarini created two global undergraduate teaching cooperations and serves as their Director. This includes: ***University of Houston-Dalian Maritime University Institute (UH-DMU Institute)***, a 4-0 program that represents the most ambitious of the UH global initiatives. Via the Institute, UH offers to students at Dalian three of its ABET accredited undergraduate engineering degrees: (i) B.S. in Electrical Engineering, (ii) B.S. in Mechanical Engineering, and (iii) B.S. in Civil Engineering. The medium of instruction for all programs is English, and UH is obliged to have its faculty teach one-third of the curriculum on the DMU campus. The Institute is in its second year, and its enrollment is ramping up quickly to what is expected to be 1200 total students (cohorts of 300) in the "steady-state". ***UH-DMU 3-1-1 Degree Program***, which brings DMU undergraduate engineering students to UH in their fourth year. During that year they take UH courses that fulfill their DMU undergraduate degree. The students then enroll at UH as graduate students and complete the M.S. in the second year. Ballarini started this program in my home Department, and subsequently included the Departments of Mechanical Engineering and Electrical and Computer Engineering. Most of the graduates of the 3-1-1 program are either working in internships in the U.S. or pursuing Ph.D. degrees at UH and other U.S. universities

Ballarini also sustains a long-standing teaching and research cooperation with the ***National Center for Research on Earthquake Engineering (NCREE***) in Taiwan. The UH Department of Civil and Environmental Engineering is involved in a long-term research collaboration with NCREE in Taiwan (which is connected to National Taiwan University). Ballarini recently signed for the second time the extension of this collaboration (it is signed every five years). The agreement allows UH structural engineering faculty and graduate students to use the unique (and very expensive) shake table at NCREE to conduct the experiments which are part of projects funded by U.S. federal grants. Ballarini's Department would not otherwise be able to conduct such research because the NCREE laboratories in Taipei and Tainan are tens of millions of dollars facilities. This has been a very fruitful collaboration that has allowed graduate students and faculty to spend time in Taipei and Tainan to participate in the experiments that comprise their doctoral dissertations, and in turn to numerous high-impact publications.

As a Distinguished Member of ASCE, Fellow of the Engineering Mechanics Institute and of ASME, and member of other professional societies, Ballarini has served the mechanical and civil engineering professions over the past 36 years. This includes being President of the Engineering Mechanics Institute of ASCE; serving on numerous technical committees of the ASME, Society of Engineering Science and ASCE, including the organization of symposia and workshops; reviewing manuscripts for a very large number of journals; serving on proposal review panels for state and federal agencies including the National Science Foundation; and serving as a referee for countless promotion and tenure cases at academic institutions in the United States and abroad. He has also worked closely with industries as a consultant, including ***General Electric Co.; Cargill, Inc.; Alcoa; Fracture Analysis Consultants; Alcatel; Nestle Research and Development; the City of Cleveland; Wright Patterson Air Force Base; Garson and Associates; Spangenberg, Shibley and Liber; Fiber Materials, Inc.; Teltech; and Nurenberg, Plevin, Heller and McCarthy.***

Publications:

Google Scholar metrics as if 8/23/24: 8205 citations, h-index 45, i10-index 103.

Selected Journal Publications with Commentary on their Impact (complete citation in complete list of publications below)

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.** ***(GS 99)***

This paper was communicated to the *Royal Society* by the late Ian Sneddon. Despite its modest number of citations, it has had extraordinary impact on the design of anchorage systems used in concrete structures and rock excavations, and concomitantly provided the correct interpretation of the non-destructive Lok-Test that was developed in Russia more than sixty years ago for assessing the *in situ* strength properties of early-age concrete. Up to the 1990's all design formulas in concrete design codes were based on plasticity (strength) theories; the fundamental assumption was that compressive and tensile strength dictated load carrying capacity in such structures. This assumption naturally carried over to the interpretation of the Lok-Test, which involves embedding (shallow) anchors throughout the concrete structure, measuring the force required to extract them, and correlating this force with the concrete tensile and compressive strengths. In fact before this paper appeared there was much debate as to which strength property (tensile, shear or compressive) the test measured. Most importantly, the assumption that the load-carrying capacity was proportional to strength meant that it scaled as the 2^{nd} power of embedment depth. This was reflected in the formulas used by engineers to design anchorage systems. Interestingly enough the concrete community recognized that formulas were unconservative; their strength predictions were always higher than those measured experimentally. The results of this paper convincingly showed that the carrying capacity of anchors, including those used in the Lok-Test, was dictated not by strength but by fracture toughness. To prove that the pull-out of an anchor from a brittle matrix is essentially a fracture toughness test, carefully conducted experiments were combined with an analytical linear elastic fracture mechanics model that treated the anchor and the curvilinear mixed-mode cracks that develop during the pullout process as continuous distributions of body forces and dislocations. The boundary conditions were represented by a system of coupled singular integral equations whose kernels were derived using the complex variable Green's function method. Comparison of the experimental results with those predicted by the model unambiguously demonstrated that the load-carrying capacity of anchors embedded in concrete and rock materials is dictated by the materials' fracture toughness and therefore scales as the 3/2 power of embedment depth; this scaling law matches the experimental data extremely well. The results of this paper are the foundation of the new design formulas for anchors in the American Concrete Institute (ACI) and International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM) codes; these formulas replaced the plasticity-based formulas, which predicted (unconservatively) that the capacity scaled as the 2^{nd} power of embedment depth. This paper thus contributed to the first and (currently) only design formulas in the ACI and RILEM codes thare are based on fracture mechanics. The success of the current design formulas that were enabled by this paper and companion papers paves the way for incorporating additional fracture mechanics insights into design procedures for concrete structures that will improve their reliability, including current discussion in ACI committees on shear and torsion resistance of concrete structures.

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. (*****GS 198*****)**

In the late 1990's there was a debate as to what mechanism was responsible for the cyclic load-induced failure of polycrystalline silicon that was reflected in experimentally produced S-N curves. One camp claimed that failure was the result of environmentally-assisted subcritical crack propagation (static fatigue) in the native oxide that is inevitably created and passivated on silicon surfaces, while Ballarini and coworkers claimed that the failures were a result of mechanical fatigue. This paper presented two different experiments that proved fatigue in polycrystalline silicon is the result of mechanical effects. The first set of experiments were similar to those presented in the *Proceedings of the Royal Society* paper described above. The environment was determined to be irrelevant by demonstrating that the reduction in strength induced by the cyclic loading was the same whether specimens were tested in a humid environment or in a vacuum. Moeover, it was shown that the mechanical fatigue was operative only for sufficiently high levels of mean stress, the ratio of maximum to minimum stress, and the magnitude of alternating stress. The variation in these control parameters was made possible by the design of the experimental setup. (Note that the reason why the other camp did not observe mechanical fatigue is that their experimental design did not allow them to apply the type of stress combinations that produced it.) The second set of experiments demonstrated that the reduction of strength required cyclic loading, and concomintantly buttressed the result that the environment does not lead to static fatigue. This was achieved by creating a specimen with a sharp crack loaded by a constant stress intensity factor, and monitoring its position for more than one month. The technical challenges involved in the design of these experiments were significant and included; using indentation to introduce a mathematically sharp crack in a beam specimen without leaving residual stresses, and having the cracked specimen loaded by a constant stress. A clever indentation technique was found that produced a text-book single edge notch specimen (with an atomically sharp crack), while the eigenstresses produced by the growth of the thin film specimen were used as the constant applied stress. The results of the experiments showed that cracks subjected to constant stress intensity factors that ranged from 60-95% of the polycrystalline silicon fracture toughness did not grow in time in a humid environment. The results and conclusions of this paper were eventually corroborated by other researchers across the globe, one of the first being a group at Bosch in Germany. It is now generally accepted that polycrystalline silicon is susceptible to mechanical fatigue.

H. Kahn, R. Ballarini, R.L. Mullen and A.H. Heuer, "Electrostatically Actuated Failure of Microfabricated Polysilicon Fracture Mechanics Specimens," ***Proceedings of the Royal Society of London*****, A455, pp. 3807-3823, 1999.** ***(GS 198)***

This is the first of many papers published by Ballarini and coworkers that broke ground on the use of microelectromechanical systems (MEMS) devices as platforms for structural testing and materials science studies at small scales. In the mid-1990's numerous groups across the globe were exploring ways of probing the material properties of materials used to fabricate MEMS and other specimens with characteristic dimensions on the order of microns. Most of the methods used to measure the properties of MEMS components required the separation ("cutting") of the specimens from the substrates upon which they were deposited, and gripping them to specialized testing equipment that could accommodate such small structures. In this paper a clever on-chip approach was introduced that eliminated the need of specialized equipment and specimen transfer. The proof-of-concept device described in the paper involved a specimen that is fully integrated with simultaneously fabricated electrostatic actuators that are capable of providing sufficient force to ensure failure under monotonic or cyclic loading. In this paper the strengths of notched beams made of polycrystalline silicon were measured after the specimens were subjected to different levels of cyclic loads, and these strengths were compared to the strengths associated with a load ramped monotonically to failure. It was shown that polycrystalline silicon structures whose characteristic dimensions on the order of microns are susceptible to mechanical fatigue, a conclusion that was buttressed in the same paper by fractographic analysis that indicated cyclic loading-induced subcritical crack propagation. The impact of this work is reflected by the adoption, at an ever-increasing rate, of MEMS platforms for materials science studies across the globe.

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. (*GS 338*)

Multiscale models of biological structures that account for the distinct length scales involved in their hierarchies abound. But this is not true of experimental techniques for measuring the mechanical properties of the building blocks of these structures whose dimensions are on the order of tens or hundreds of nanometers. Bone has five levels of hierarchies, one of them being its collagen fibrils building blocks. This paper was the first (and still only) to present the stress-strain response of individual collagen fibrils subjected to uniaxial tension up to failure. These experiments, which involve very difficult techniques for isolating the fibrils, pulling them out of solution, attaching them to MEMS platforms, and pulling them to failure, have not yet been accomplished by other researchers. In fact the total number of citations of the half-dozen papers Ballarini published on collagen fibrils is on the order of hundreds and will continue to grow because the data presented in the papers is the only data available. The paper presents numerous insights and first-time data that is critical to the development and assessment of multiscale models. First, it showed that collagen fibrils can achieve a good part of a GPa strength and ultimate strains up to more than 200%. The results also showed that collagen fibrils do not behave as elastic materials but instead exhibit viscoelasticity and self-healing, something that was modeled analytically and computationally in subsequent papers by Ballarini and coworkers. Perhaps most importantly, the experimental data suggests that the mechanical properties of these structures are size dependent and stochastic. This means that if a deterministic model, for example a molecular dynamics model, is calibrated using the results from one (or more) experiments, then most likely the model would not be able to quantitatively predict the behavior of a different specimen. The impact of this paper is expected to include the impetus for modelers of collageneous structures to adopt statistical and stochastic approaches to modeling. Subsequent papers from Ballarini and coworkers investigated other behaviors of collagen, including its relaxation times and the role of moisture.

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.** ***(GS: 749)***

This highly cited publication is recognized as seminal within the context of bioinspired design of fracture-resistant synthetic materials. Carefully-conducted experiments, together with elegant theoretical and computational fracture mechanics models, were used to explain the basis for the superior toughness of the highly mineralized shells of a certain mollusk containing the crossed lamellar architecture. The first step in "reverse engineering" of the crossed-lamellar structure of *Strombus gigas*, which is comprised of 97% (brittle) aragonite and 3% (ductile) proteinaceous glue, involved the use of scanning electron and transmission electron microscopes to clearly identify the architecture of the shell, which is achieved by assemblying and gluing together large aspect ratio/highly twinned aragonite crystals into lamellae of three distinct length scales. It was demonstrated that the resistance of the shell to catastrophic fracture can be understood quantitatively by invoking two energy-dissipating mechanisms: multiple microcracking in the outer layers at low mechanical loads, and large-scale crack bridging in the shell's tougher middle layers at higher loads. The details of theoretical and computational fracture mechanics models used to partition the work of fracture, specifically energy-based analysis of the evolution of interacting tunneling cracks (similar to those created in stressed thin films on substrates) at lower loads and large-scale bridging simulations of sub-critical crack propagation at higher loads, were presented in companion papers. This paper (and companion papers) demonstrated that the shell of *Strombus gigas* achieved the Aveston-Cooper-Kelly limit (the goal of designers of ceramic-matrix-composites components), which corresponds to the realization of consecutively created steady-state cracks that extend through the composite while the reinforcement remains intact, and eventually to a graceful failure and a large work of fracture. This paper thus showed that the crossed-lamellar architecture offers promise for the biomimetic design of tough, lightweight ceramic composites. In addition, this paper provided a lesson to the field of functionally graded materials, by illustrating that while grading properties in one direction could lead to improved toughness, "quantum jumps" in toughness require two-dimensional grading of properties and structure. At the time of publication the realization of such structures was "pie in the sky," but with the advent of fabrication techniques such as 3D-printers hierarchical structures with complex geometries, which were inspired by works including this paper, is a real possibility as demonstrated by numerous recent 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; Complete List

130. J.Z. Chen, H. Wu, J.Z. Zhou, Z.Y. Li, K. Duan, R.H. Xu, T.Y. Jiang, H.Y. Jiang, R. Fan, R. Ballarini and Y. Lu, "Heterostructured Mechanical Metamaterials Inspired by the Shell of *Strombus gigas*,"*Journal of the Mechanics and Physics of Solids*, Vol. 188, July 2024, DOI 10.1016/j.jmps.2024.105658.
129. Z. Bhaizhikova, R. Ballarini and J.L. Le, " Uncovering the Dual Role of Dimensionless Radius in Buckling of Spherical Shells with Random Geometric Imperfections," *PNAS*, Vol. 121, No. 16, April 16, 2024, DOI 10.1073/pnas.2322415121.
128. J. Xue, Z. Bhaizhikova, R. Ballarini and T. Chen, "Creating Geometric Imperfections in Thin-Walled Structures Using Acoustic Excitation," *Journal of Applied Mechanics-Transactions of the ASME*, Vol. 90, No. 12. Dec. 1, 2023, DOI 10.1115/1.4062746.
127. L. Xue, X.D. Ren and R. Ballarini, "Damage-Plasticity Modeling of Shear Failure in Reinforced Concrete Structures," *Engineering Fracture Mechanics*, Vol. 290, Sep. 27, 2023, DOI 10.1016/j.engfracmech.2023.109536.
126. J.Y. Ye, R. Ballarini and L.W. Zhang, "A Nonlinear and Rate-Dependent Fracture Phase Field Framework for Multiple Cracking of Polymer," *Computer Methods in Applied Mechanics and Engineering*, Vol. 410 May 15, 2023, DOI 10.1016/j.cma.2023.116017.
125. Z. Bhaizhikova, JL Le and R. Ballarini, "Stochastic Buckling of Geometrically Imperfect Beams on Elastic Foundation," *ASME Journal of Applied Mechanics*, Vol. 90 (1), Jan. 1, 2023.
124. R. Ballarini, C. Boni and G.R. Carfagni. "Geometry of Sliding Lamellae Dictates the Constitutive Properties of Nacre-Like Hierarchical Materials," *Journal of the Mechanics and Physics of Solids 167*, Article Number: 105000, October, 2022.
123. L. Mello, J. Le and R. Ballarini, "Effect of Time-Dependent Bond Slip on Delayed Failure of Reinforced Concrete Frames," ASCE *Journal of Engineering Mechanics*, Vol. 148(9), September 2022.
122. F. Zhu, J.D. Zhou, R. Ballarini, S.T. Peng and S.W. Chen, "Peridynamic Modeling of Stochastic Fractures in Bolted Glass Plates," *Mechanics Research Communications*, Vol. 122, Article Number 103890, June 2022.
121. X.D. Ren, X.L. Wei and R. Ballarini, "A Temporal Multiscale Model for Fatigue Damage of Concrete," *ASCE Journal of Engineering Mechanics*, Vol. 148(3), Mar. 1, 2022.
120. A. Bessmertnykh, E. Dontsov and R. Ballarini, "A Semi-Infinite Hydraulic Fracture Driven by a Sequence of Power-law Fluids," *ASCE Journal of Engineering Mechanics*, Vol. 147(10), Oct. 1, 2021.
119. I. Protasov, E. Dontsov and R. Ballarini, "Enhanced Pseudo-3D Model for Multiple Hydraulic Fractures," *ASME Journal of Applied Mechanics*, Vol. 88, Issue 1, Article Number 011003, Jan. 1, 2021.

118. “A Multifield Model for Early-Age Massive Concrete Structures: Hydration, Damage, and Creep,” *ASCE Journal of Engineering Mechanics*, Vol. 146, Issue 10, October 2020.
117. L. Mello, J. Le and R. Ballarini, “Numerical Modeling of Delayed Progressive Collapse of Reinforced Concrete Structures,” *ASCE Journal of Engineering Mechanics*, Vol. 146, Issue 10, October 2020.
116. E. Dontsova, R. Ballarini and B.I. Yakobson, ”Dimensionality Effects in Crystal Plasticity: From 3D Silicon to 2D Silicene,” *Extreme Mechanics Letters* 40 (2020) 100892.
115. A. Bessmertnykh, E. Dontsov and R. Ballarini, “The Effects of Proppant on the Near-Front Behavior of a Hydraulic Fracture,” *Engineering Fracture Mechanics* 235 (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. P. Saez, S.J. Eppell, R. Ballarini and F. Rodriguez Matas, “A Complementary Approach Accomodates Scale Differences in Soft Tissues,” *Journal of the Mechanics and Physics of Solids*, Vol. 138, Article 103895, May 2020.
112. 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.
111. Z. Hu, R. Ballarini and J. Le, “A Renewal Weakest-Link Model of Strength Distributioon 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. Devincre, 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 Mammaliam Collagen Fibrils," *Interface Focus* Vol. 6, Issue: 1, Article: 20150080, Feburary 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 Phasde-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.
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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.

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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

142. "Fracture Mechanics Design of Anchorage," presented to Stanford University Department of Civil and Environmental Engineering, March 1, 2023.
141. "Fracture Mechanics Design of Anchorage," presented to Texas A&M Department of Civil and Environmental Engineering, October 21, 2022.
140. "Reverse Engineering of the Shells of Mollusks: an Example of Bioinspired Design," presented to Stanford University Department of Mechanical Engineering, October 13, 2022.
139. "Are Configurational Forces Real Forces," presented at the mini-symposium in honor of Professor Kyung-Suk Kim, U.S. National Congress of Applied Mechanics, Texas A&M University, October 17, 2022.
138. "Are Configurational Forces Real Forces," Engineering Mechanics Institute Conference, Johns Hopkins University, June 2, 2022.
137. "Effect of Time-Dependent Bond Slip on Delayed Failure of Reinforced Concrete Frames," Engineering Mechanics Institute Conference, Johns Hopkins University, June 1, 2022.

136. “Ancient and Modern Structures in Italy: An Analysis by Professor Ballarini, The Italian Cultural and Community Center of Houston, May 10, 2022.
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 80th 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 Speciments swith 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 4th 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,” 7th 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 Speciments 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 Speciments 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 Speciments 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 Speciments 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 Infrastructrue: The Effects of our Decaying Instrastructure 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,” 9th 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,” 19th Panhellenic Conference/Summer School, Nonlinear Science and Complexity, Thessaloniki, Greece, July 12, 2006.

60. “Structural Testing at the Micro and Nano Scales,” 3rd 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 Universityu of Science and Technology, April 27, 2006.

57. “Structural Testing at the Micro and Nano Scales,” Institute of Applied Mechancis, 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, Universita 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,” Instituto 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," Instituto 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," Instituto 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 Cocrete 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”

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 Fow 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, Department of Civil and Environmental Engineering, University of Houston
Thesis: Theoretical and Computational Modeling Study of Flow Through Porous Media with Double Porosity/Permeability.

Davide Giannuzzi, Ph.D. 2016, Department of Civil, Environmental and Geo Engineering, 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

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

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