Michael Ortiz

Academic career

1979 - 1982	Research Assistant, Department of Civil Engineering, University of California, Berkeley, CA, USA
1981	PhD, University of California, Berkeley, CA, USA (thesis advisor: E.P. Popov)
1982 - 1983	Postdoctoral Fellow, Department of Mathematics, Ministry of Public Works, Madrid, Spain
1983 - 1984	Research Scientist, Computational Hydrodynamics Program, Department of Coasts and Harbors, Ministry of Public Works, Madrid, Spain
1984 - 1987	Assistant Professor of Engineering, Brown University, RI, USA
1987 - 1990	Associate Professor of Engineering, Brown University, RI, USA
1990 - 1995	Professor of Engineering, Brown University, RI, USA
1995 - 2004	Professor of Aeronautics and Mechanical Engineering, California Institute of Technology, CA, USA
2004 - 2013	Dotty and Dick Hayman Professor of Aeronautics and Mechanical Engineering, California Institute of Technology, CA, USA
2008 - 2013	Director, Caltech's DoE/PSAAP Center for the Predictive Modeling and Simulation of High-Energy Density Dynamic Response of Materials, CA, USA
Since 2013	Frank and Ora Lee Marble Professor of Aeronautics and Mechanical Engineering, California Institute of Technology, CA, USA
Since 2016	Bonn Research Chair, University of Bonn

Honours

1977 - 1978	Fulbright Scholarship, University of California, Berkeley, CA, USA
1994 - 1995	Sherman Fairchild Distinguished Scholar, California Institute of Technology, CA, USA
2002	Humboldt Research Award for Senior U.S. Scientists, Alexander von Humboldt Stiftung, Germany
2002	Computational Mechanics Award for Research, International Association for Computational Mechanics (IACM)
2007	Computational Structural Mechanics Award, U. S. Association for Computational Mechanics (USACM)
2007	Elected Fellow of the U. S. American Academy of Arts & Sciences
2008	Rodney Hill Prize, Intl. Union of Theoretical and Applied Mechanics (IUTAM)
2010	Hans Fischer Senior Fellowship, Institute for Advanced Study, TU Munich, Germany
2011	Prize of the Spanish Association for Numerical Methods in Engineering (SEMNI)
2013	Elected Member of the U. S. National Academy of Engineering
2014	IUTAM Symposium in honour of 60th birthday, Burg Schnellenberg, Germany
2015	Timoshenko Medal, American Society of Mechanical Engineers (ASME)
2016	Journal of the Mechanics and Physics of Solids, 60th Birthday Special Volume
2018	Doctorate Honoris Causa, Polytechnic Universidad of Madrid (UPM)

Invited Lectures

	Recent Plenary Lectures
2007	49th British Applied Mathematics Colloquium, BAMC 2007, Bristol, England, UK
2007	9th Intl. Conf. Computational Plasticity, COMPLAS IX, Barcelona, Spain
2008	8th World Congress on Computational Mechanics, Opening Lecture, Venice, Italy
2008	22nd Intl. Con. Theoretical & Applied Mechanics, Hill Medal Lecture, Adelaide, SA, Australia
2009	10th Intl. Conf. Computational Plasticity, COMPLAS X, Barcelona, Spain
2010	Fifth Intl. Conference on Multiscale Materials Modelling, MMM2010, Freiburg
2010	IX Argentinean Congress Comput. Mech., MECOM2010, Buenos Aires, Argentina
2011	Congress on Numerical Methods in Engineering, CNME2011, Coimbra, Portugal
2011	11th Intl. Conf. Computational Plasticity, COMPLAS XI, Barcelona, Spain
2012	European Solids Mechanics Conference, ESMC2012, Graz, Austria
2012	European Congress Comp. Meth. Appl. Sci. Engr., ECCOMAS 2012, Vienna, Austria
2013	12th Intl. Conf. Computational Plasticity, COMPLAS XII, Barcelona, Spain
2014	11th World Congress on Computational Mechanics, WCCM XI, Barcelona, Spain
2015	Intl. Conf. Computational Modelling of Fracture, CFRAC, Paris, France
2015	13th Intl. Conf. Computational Plasticity, COMPLAS XIII, Barcelona, Spain
2015	American Society of Mechanical Engineers, Timoshenko Lecture, Houston, TX, USA
2017	Comp. Modeling Complex Materials Across Scales, ECCOMAS CMCS 2017, Paris, France
2017	14th Intl. Conf. Computational Plasticity, COMPLAS XIV, Barcelona, Spain

Editorships

Current Editorships:

- International Journal for Numerical Methods in Engineering (since 1996)
- Computer Methods in Applied Mechanics and Engineering (since 1996)
- Journal of the Mechanics and Physics of Solids (since 1999)
- Archive for Rational Mechanics and Analysis (since 1999)

Research Area B I am interest in mathematically based materials modelling and computational mechanics. A particular focus in this research area is on variational methods that allow to predict the effective behaviour of many dislocations and other imperfections in solids, with a view towards macroscopic models for failure. While the low-stress deformation of metals is almost completely characterized by the theory of elasticity, a variety of other deformation mechanisms appear at large stresses. Materials undergo damage, cavitation, plastic deformation, and fracture. Many of these processes are mediated by the creation and motion of dislocations, which are localized defects of the crystal lattice and can be seen as line-singularities of the elastic strain field. Although the existence of dislocations has been known for a century and many properties are phenomenologically well understood, there are many open questions. Analogously local damage, including in particular microvoids and cavities, plays a fundamental role in the development of fracture, but the relation between dislocations, damage and plasticity is up to now only understood at a phenomenological level. My particular interest is in the study of dislocation structures and their interaction and the modeling and analysis of ductile fracture starting from a model which accounts for the formation of microscopic voids and localization of tensile deformation.

Supervised theses

Diplom theses: 3
PhD theses: 51

Selected PhD students

Bo Li (2009): “The optimal transportation method in solid mechanics”,
now Assistant Professor, Case Western Reserve University, OH, USA
Leonard J. Lucas (2009): “Uncertainty quantification using concentration-of-measure inequalities”,
now Senior Engineer, Bechtel Marine Propulsion Corporation, USA
Julian J. Rimoli (2009): “A computational model for intergranular stress corrosion cracking”,
now Assistant Professor, Georgia Institute of Technology, GA, USA
Benjamin L. Hansen (2009): “Modeling metallic single crystal plastic hardening through the evolution of dislocation subgrain structures”,
now Scientist, Theoretical Division, Los Alamos National Laboratory, USA
Daniel Hurtado (2010): “Multiscale modeling of microcrystalline materials”,
now Associate Professor, Pontifical Catholic University of Chile, Santiago de Chile, Chile
Celia Reina (2010): “Multiscale modeling and simulation of damage by void nucleation and growth”,
now Assistant Professor, University of Pennsylvania, Philadelphia, PA, USA
Luigi Perotti (2010): “Modeling the behavior of fiber reinforced sandwich structures subjected to underwater explosions”,
now Postdoctoral Scholar, University of California, Los Angeles, CA, USA
Gabriela Venturini (2010): “Topics in multiscale modeling of metals and metallic alloys”,
now Software Engineer, DreamWorks Animation, CA, USA, and Adjunct Professor, Occidental College, CA, USA
Marcial Gonzalez (2010): “Energy and force stepping integrators in Lagrangian mechanics”,
now Assistant Professor, Purdue University, IN, USA
Gwendolyn (Gwen) Johnson (2012): “Modeling, simulation, and design of self-assembling space systems: accurate collision detection, robust time integration, and optimal control”,
now Assistant Professor, Notre Dame University, South Bend, IN, USA
Landry Fokoua Djodom (2013): “Optimal scaling in ductile fracture”,
now Researcher, Exalon, Baltimore, MD, USA
Stefanie Heyden (2014): “Micromechanical damage and fracture in elastomeric polymers”,
now Academic Staff, University of Bonn
Panagiotis P. Natsiavas (2016): “Stability of electrode-electrolyte interfaces during charging in lithium batteries”,
now Postdoctoral Fellow, Massachusetts Institute of Technology, Cambridge, MA, USA

Brandon Runnels (2016): “A model for energy and morphology of crystalline grain boundaries with arbitrary geometric character”,
now Assistant Professor, University of Colorado, Colorado Springs, CO, USA
Trenton T. Kirchdoerfer (2017): “Data-Driven Computing”,
now Postdoctoral Scholar, California Institute of Technology, Pasadena, CA, USA

Selected publications

[1] Kaushik Bhattacharya, Thomas Blesgen, Vikram Gavini, Michael Ortiz, and Phanish Suryanarayana. Non-periodic finite-element formulation of kohn-sham density functional theory. *J. Mech. Phys. Solids*, 58(2):256–280, 2010.

[2] M. Arroyo, C. J. Cyron, and M. Ortiz. Smooth, second order, non-negative meshfree approximants selected by maximum entropy. *Internat. J. Numer. Methods Engrg.*, 79(13):1605–1632, 2009.

[3] Tamer El Sayed, Fernando Fraternali, Alejandro Mota, and Michael Ortiz. Biomechanics of traumatic brain injury. *Computer Methods in Applied Mechanics and Engineering*, 197(51):4692–4701, 2008.

[4] Jaroslaw Knap, Yashashree Kulkarni, and Michael Ortiz. A variational approach to coarse graining of equilibrium and non-equilibrium atomistic description at finite temperature. *J. Mech. Phys. Solids*, 56(4):1417–1449, 2008.

[5] Sigrid Leyendecker, Jerrold E. Marsden, and Michael Ortiz. Variational integrators for constrained dynamical systems. *ZAMM Z. Angew. Math. Mech.*, 88(9):677–708, 2008.

[6] Kaushik Bhattacharya, Vikram Gavini, and Michael Ortiz. Quasi-continuum orbital-free density-functional theory: a route to multi-million atom non-periodic dft calculation. *J. Mech. Phys. Solids*, 55(4):697–718, 2007.

[7] M. Arroyo and M. Ortiz. Local maximum-entropy approximation schemes: a seamless bridge between finite elements and meshfree methods. *Internat. J. Numer. Methods Engrg.*, 65(13):2167–2202, 2006.

[8] A. Mota, M. Ortiz, and K. Weinberg. A variational constitutive model for porous metal plasticity. *Computational Mechanics*, 37(2):142–152, 2006.

[9] A. Mota, M. Ortiz, and Q. Yang. A finite-deformation constitutive model of bulk metallic glass plasticity. *Computational Mechanics*, 37(2):194–204, 2006.

[10] M. Ortiz, L. Stainier, and Q. Yang. A variational formulation of the coupled thermo-mechanical boundary-value problem for general dissipative solids. *J. Mech. Phys. Solids*, 54(2):401–424, 2006.