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Education

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|-------|--------------------------|---|
| Ph.D. | Yale University | New Haven, CT 06520
Council of Engineering and Applied Science
Area of Study: Theoretical and Applied Mechanics
Dissertation: "Evaluation of Bounds to the Effective Yield Surface for Face-Centered Cubic Polycrystalline Materials." |
| M.S. | Yale University | New Haven, CT 06520
Council of Engineering and Applied Science,
Area of Study: Theoretical and Applied Mechanics |
| M.S. | Brigham Young University | Provo, UT 84602
Major: Mechanical Engineering,
Thesis: "X-Ray Line Broadening Characterization of Strain In-homogeneity in Textured Copper Rods." |
| B.S. | Brigham Young University | Provo, UT 84602
Major: Mechanical Engineering |

Research Expertise

Application of the principles of theoretical and applied mechanics to multi-scale material modeling of polycrystalline materials: derivation of overall mechanical properties, such as the yield surface governing plastic flow, through homogenization of microstructural information, including

- Continuum homogenization
- Theoretical plasticity
- Anisotropic plasticity
- Continuum mechanics
- Dislocation mechanics
- Statistical continuum theories
- Single-crystal plasticity
- Deformation mechanisms
- Material characterization
- Orientation Imaging Microscopy

Professional Expertise

- Conducting computer modeling and simulation for weapon system reliability and design
- Computational structural analysis (linear/nonlinear, static/dynamics, thermal).
 - Verification and validation methodologies for reliability assessment of engineering computational analyses, models and design.
 - Development, application and evaluation of material constitutive models.
 - Multi-scale material modeling: micro/meso-scale, meso/continuum-scale.

Computer Software Experience

Proficient in: DYNA3D/PARADYN, NIKE3D, LS-DYNA, TRUGRID

Experienced in: ALE3D, ABAQUS, NASTRAN, MATLAB

Teaching and Mentoring Experience**Utah State University**

Courses Taught

- Introduction to Manufacturing
- Introduction to Engineering Design
- Physics by Exploration
- Materials Science and Engineering
- Physics for Scientists and Engineers I
- Physics for Scientists and Engineers II
- Introduction to Computer Programming
- Electronics Laboratory
- Engineering Mechanics: Statics
- Engineering Mechanics: Strength of Materials

Advisement Roles

- Pre-Engineering Students (Freshman and Sophomore)
- High School and Jr. High Robotics Teams
- Middle School Science Fair

Lawrence Livermore National Laboratory

- Instructed managers in uncertainty quantification and sensitivity analysis in computational analyses.
- Mentored interns and summer students in engineering and computation analyses.
- Mentored postdoctoral research fellows and visiting scholars in multi-scale material modeling and homogenization.

Yale University and Brigham Young University

- Taught course sections in representation of material microstructure and properties to first year graduate students in advanced materials science courses. Developed and graded the midterm examinations.
- Taught laboratory sections to undergraduate students in experimental methods in engineering and applied science.

Employment History

Utah State University Uintah Basin Campus
7000 320 N Aggie Blvd (2000 W), Vernal, UT 84078

Major Contributions:

- Teaching and developing courses in engineering and physics, mentoring, and advising students (see above).

Lawrence Livermore National Laboratory Defense Technology Engineering Division
7000 East Avenue
Livermore, California, 94551

Major Contributions:

- Performed large-scale hydrodynamic computation of shock loaded, fragmenting components using Lagrangian finite element methods and statistics based fracture and damage models. These calculations, involving models up to 80 million zones, pushed the edge of our computational capabilities. These studies aided in understanding the statistics of fragmenting projectiles from exploding bodies.
- Developed and implemented verification and validation methodologies for computational analyses including software quality assurance and uncertainty quantification. This work aided in understanding and predicting reliability of stockpile weapons.
- Leader for LLNL in the Tri-Lab Verification Working Group. Coordinated external efforts to obtain, distribute and participate in large-scale scaling studies and comparisons between internally and externally developed finite element codes on the MPP platform. Defined problem suites for verifying the physics-based models in the codes and led summer interns to conduct the verification studies. These activities facilitated the development, debugging and application of the latest computational technology to our evolving large-scale computing environment.
- Applied and modified material constitutive models, in finite element codes, for plasticity and damage modeling, thus enabling more precise prediction of a material's deformation response. Some of these computational models were validated using electromagnetically driven expanding rings.
- Conducted large-scale modeling of complex weapon systems for computation of severe impact accident scenarios, severe operational environments and thermal-mechanical cook-off response.
- Represented the engineering department, for verification and validation, on the code assessment and review team for the Accelerated Strategic Computing Initiative (ASCI), contributed to the Tri-Lab, and coauthored the LLNL internal Software Quality Engineering (SQE) policy documents, respectively.
- Managed post-doctoral fellows and visiting scholars in developing theory and methods in non-local plasticity for constitutive models and yield surface representation, in support the homogenization

efforts for the multi length-scale modeling program.

Ceramatec, Inc. Oxygen Generator and Fuel Cell Department
Salt Lake City, UT 84119

Major Contributions:

- Managed all solid mechanics and thermal-mechanical analyses (NIKE, DYNA TOPAZ).
- Conducted computer-aided structural design and mechanical testing of ceramic components and systems for solid oxide and ion conducting devices, leading to design improvements.
- Developed constitutive modeling and validation tests for high temperature creep and superplastic behavior of ceramic materials.

Lawrence Livermore National Laboratory
New Technologies Engineering Division
7000 East Avenue
Livermore, California, 94551

Major Contributions:

- Developed and implemented models for single and polycrystalline plasticity into implicit finite element. These models were applied to study strain localization phenomena in aluminum bicrystals.
- Managed post-doctoral fellows and visiting scholars in homogenization methods for grain interaction behavior with length-scale modeling (e.g. strain gradient plasticity).
- Studied and applied material constitutive laws for flow behavior of superplastic and sheet metal forming processes and dynamic behavior of soils, rocks and concrete.

Yale University New Haven, CT 06520

Major Contributions:

- Graduate Research and Teaching Assistant
- Conducted fundamental research and developed bounding relations for representation and homogenization of yield surfaces in polycrystalline materials with application of orientation imaging microscopy. This research resulted in a journal publication and successful completion of doctoral thesis.
- Developed tensorial representations of orientation distribution and N-point correlation functions for microstructural homogenization using group theory and harmonic polynomials. This research resulted in three journal publications.
- Taught undergraduate and graduate students in structural mechanics, system dynamics and mechanical behavior of materials.

Lawrence Livermore National Laboratory
Weapons Engineering Division and Nuclear Test Engineering Division
7000 East Avenue
Livermore, California, 94551

Major Contributions:

- Completed nonlinear Lagrangian finite element analysis of mechanical and structural components and systems using NIKE

(implicit) and DYNA (explicit).

- Developed a rigid body dynamics code for complex linkage systems.
- Conducted Lagrangian and Eulerian hydrodynamic simulations of shock loading of structures and high-rate forming applications for materials.
- Completed quasi-static structural evaluations for down-hole lifting bails in support of the Nevada underground experiments.
- Conducted many calculations for parametric studies of the effects of geological parameters for development of an earth penetrator weapon.
- Studied and applied material constitutive laws for flow behavior of super-plastic and sheet metal forming processes and dynamic behavior of soils, rocks and concrete. These studies aided in the understanding and development of near net shape manufacturing processes.

Eastman Kodak Company Applied Technology Organization
Rochester, NY 14650

Major Contributions:

- Worked in the general area of computer-aided mechanical, structural and thermal design and analysis.
- Performed static and dynamic analysis of mechanical, structural, and fluid systems using commercial and in-house finite element and numerical software (MSC/NASTRAN, PATRAN, FIDAP, FLUENT, ANVIL 4000/5000 etc.)...
- Performed static structural analysis of manufacturing equipment and dynamic analysis of consumer products.
- Developed models of molten plastics for injection molding operations for understanding and design of manufacturing processes.

Brigham Young University Department of Mechanical Engineering
Provo, UT 84602

Major Contributions:

- Graduate Research and Teaching Assistant.
- Conducted fundamental research on microstructural characterization of polycrystalline materials using x-ray diffraction and mechanical testing methods. This research resulted in a publication and successful completion of MS thesis.
- Taught undergraduate students in experimental methods of engineering and applied science.

Honors, Awards and Recognitions

- 2006 National Nuclear Security Administration (NNSA) Award of Excellence: “For Significant Contributions to the Stockpile Stewardship Program. For demonstrating the safety case for transportation operations of nuclear explosives on the U.S. public highway system.”
- 2006 National Nuclear Security Administration (NNSA) Award of Excellence: “For Significant Contributions to the Stockpile Stewardship Program. For

- outstanding performance developing and defending the safety basis for offsite transportation of nuclear explosives.”
- 2005 Lawrence Livermore National Laboratory Energetic Materials Center Employee Recognition Award: “For your outstanding commitment and technical support as a key member of the milestone team, which led to successful on-time completion of the FY2005 Campaign 2 Level 2 milestone #1472, Validate Interim 3-D Slow Cookoff Model for LX-04 for Weapons Explosive Safety Studies.”
 - 2003 Lawrence Livermore National Laboratory Defense and Nuclear Technology Award: “In appreciation for your contribution to the Advanced Scientific Computing (ASC) Verification and Validation Program.”
 - 2003 Sandia National Laboratory Employee Recognition Award: “A head-on impact test of a Safeguards Transporter (SGT) was successfully conducted to obtain cargo-tiedown response data for accessing severe transportation accidents.”
 - 1999 Lawrence Livermore National Laboratory Defense and Nuclear Technology Award:
”In appreciation for your contribution to the W87 Life Extension Program.”
 - 1999 Department of Energy Defense Programs Award of Excellence: “For significant Contributions to the Stockpile Stewardship Program.”
 - Tau Beta Pi National Engineering Honor Society, Elected April 5, 1983.

Short Courses and Other Training

- Probabilistic Analysis and Design. Presented by The Southwest Research Institute at the Los Alamos National Laboratory. June 21-24, 2004. Instructors: Ben Thacker, Ph.D., Luc Huyse, Ph.D. and David Riha, Ph.D.
- Project Risk and Opportunity Management. UCLA Extension. February 23, 2004. Instructor: Stephen L. Carman.
- Managing System Development Projects. UCLA Extension. February 11-12, 2004. Instructor: Arnold M. Ruskin, Ph.D., P.E., PMP.
- Cost Estimation of Projects. UCLA Extension. February 9, 2004. Instructor: Donald S. Remer, Ph.D., P.E.
- Bradford Best Practice Project Management. April 8-10, 2003. Instructor: Jim Bradford.
- Introductory LS-OPT, Design Optimization for Engineering Analysis. October 17-19, 2001. Instructor: Nielen Stander, Ph.D.
- LS-DYNA User Defined Material Modeling. December 7-8, 1998. Instructor: Ala Tabiei, Ph.D.
- Introductory LS-DYNA. April 5-9, 1998. Instructor: John D. Reid, Ph.D.

Review Committees

- DOE/NNSA Advanced Scientific Computing (ASC) University Partnership Review. Conducted two-year review of the University of Utah’s Center for Simulation of Accidental Fires and Explosions (C-SAFE). Representative for verification and validation. FY2004 – FY2005.
- DOE/NNSA Codes for the Complex Committee. Represented LLNL to define direction and roadmap for engineering analysis code development, application and V&V for the nuclear weapons complex. Also served as the organizing committee

- for the Annual Nuclear Weapons Engineering Analysis Conference (NWEAC).
FY2001-FY2005.
- DOE/NNSA Tri-Laboratory Independent Review Team for Software Quality Engineering (SQE) Policy. Represented LLNL for verification and validation. FY2000 – FY2001.

Research Publications

Journal Papers

"Angry Birds Realized: Water Balloon Launcher for Teaching Projectile Motion With Drag", with B. Edwards, M. A. Christiansen, W. A. Booth and L. O. Jessup, 2014, *European Journal of Physics*, accepted for publication.

"Tensorial representation of two-point correlation functions for polycrystalline microstructure by harmonic polynomials", with P. I. Etingof and B. L. Adams, 1995, *Philosophical Magazine A*, **72**, 199.

"Theory of Grain Boundary Structure Effects on Mechanical Behavior", with B. L. Adams, T. A. Mason and T. Olson, 1994, *Material Science Forum*, **157-162**, 1731.

"Coordinate Free Tensorial Representation of N-Point Correlation Functions for Microstructure by Harmonic Polynomials", with B. L. Adams and P. I. Etingof, 1994, *Material Science Forum*, **157-162**, 287.

"Coordinate Free Tensorial Representation of the Orientation Distribution Function with Harmonic Polynomials", with E. T. Onat, P. I. Etingof and B. L. Adams, 1993, *Textures and Microstructures*, **21**, 233.

"Orientation and Strain Dependence of Stored Energy of Cold Work in Axisymmetric Copper", with B. L. Adams, 1986, *Metallurgical Transactions*, **17A**, 563.

Conference Papers

"Team Teaching that Goes the Distance: Team Instruction for a Broadcast Introductory Engineering Course", with A. L. Minichiello, T. Blake and W. H. Goodridge, *Proceedings of the 118th ASEE Annual Conference & Exposition*, 2011.

"Virtual Proving Ground for Assessing Reliability and Uncertainty", with H. Hsieh, *Proceedings of Foundations '04 V&V Workshop*, 2004, UCRL-CONF-205448.

"Yielding in Polycrystals: Computation of a New Upper Bound Using Two-Point Statistics", with T. Olson and B. L. Adams, *Proceedings of the Fourth International Symposium on Plasticity and its Current Application*, 1993, A. Khan (Ed.), Baltimore.

Internal Papers

"LLNL Site-Specific ASCI Software Quality Engineering Recommended Practices", with N. Storch, D. Miller, P. Miller, E. Dube, L. Cook, S. Louis, T. Quinn, C. Nitta and R. Klein, 2001, UCRL-ID-143698.

"Multilength-Scale Modeling: Crystal-Plasticity Models in Implicit Finite Element Codes", *Thrust Area Report: Engineering Research, Development and Technology*, 1995, G.L. Goudreau (Ed.), UCRL 53868-95.

(Numerous additional internal documents have been written, most of which are of defense related work and cannot be enumerated here.)

Professional Conferences and Workshops

Seventh Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, September 4-6, 2007.

Fifth Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, September 7-9, 2005.

Advanced Scientific Computing (ASC) Verification and Validation Tri-Laboratory Workshop, Lawrence Livermore National Laboratory, Livermore, CA, January 25-27, 2005.

Fourth Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, December 14-16, 2004.

Workshop on Impact Response of Explosives and Propellants, Lawrence Livermore National Laboratory, Livermore, CA, October 29, 2004.

Accelerated Strategic Computing Initiative (ASCI) Principal Investigator's Meeting, Las Vegas, NV, March 1-5, 2004.

Fifth Biennial Tri-Laboratory Engineering Conference on Computational Modeling, Santa Fe, NM, October 21-23, 2003.

Foundation '04 Verification and Validation Workshop, The Society for Modeling and Simulation International (SCS), Tempe, AZ, October 13-15, 2004.

Engineering Analysis Ad-Hoc Working Group (HOCWOG) Meeting, The Atomic Weapons Establishment (AWE), Aldermaston, UK, September 8-12, 2003.

Third Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, September 3-5, 2003.

Second Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, September 4-6, 2002.

Accelerated Strategic Computing Initiative (ASCI) Principal Investigator's Meeting, Kings Bay, GA, January 6-10, 2002.

Accelerated Strategic Computing Initiative (ASCI) Verification Workshop, Los Alamos National Laboratory, Los Alamos, NM, November 28-29, 2001.

Fourth Biennial Tri-Laboratory Engineering Conference on Computational Modeling, Albuquerque, NM, October 21-23, 2001.

First Annual Nuclear Weapons Engineering Analysis Conference, Naval Post Graduate School, Monterey, CA, September 5-7, 2001.

Accelerated Strategic Computing Initiative (ASCI) Principal Investigator's Meeting, Los Alamos, NM, January 22-25, 2001.

The Joint Working Group Meeting (JOWOG-31) for Engineering Analysis and Testing Methodologies, The Atomic Weapons Establishment (AWE), Aldermaston, UK, October 16-20, 2000.

Engineering Analysis Ad-Hoc Working Group (HOCWOG) Meeting, The Atomic Weapons Establishment (AWE), Aldermaston, UK, October 11-13, 2000.

Accelerated Strategic Computing Initiative (ASCI) Principal Investigator's Meeting, Livermore, CA, January 21- February 3, 2000.

ASME Mechanics and Materials Conference, Virginia Polytechnic Institute and State University, Blacksburg, VA, June 27-30, 1999.

Thirteenth U. S. National Congress of Applied Mechanics, University of Florida, Gainesville, FL, June 21-26, 1998.

Accelerated Strategic Computing Initiative (ASCI) Principal Investigator's Meeting, Kansas City, MO, January 26-30, 1998.

ASME Mechanics and Materials Conference, The Johns Hopkins University, Baltimore, MD, June 12-14, 1996.

Fall Meeting of the Metallurgical Society (Materials Week), Cleveland, OH, October 30 - November 3, 1995.

Workshop on Micromechanics of Materials Processing and Manufacturing, The Institute for Mechanics and Materials, Brown University, Providence RI, June 1995.

First International Conference on Composites Engineering, New Orleans, LA, August 28-31, 1994.

Fourth International Symposium on Plasticity and its Current Applications, Baltimore, MD, July 19-23, 1993.

Workshop on Computer Modeling of Fabrication Processes and Constitutive Behavior of Materials, The Canada Center for Mineral and Energy Technology, Ottawa, ON, May 1986.

Fall Meeting of the Metallurgical Society (Materials Week), Toronto, ON, October 13 - 17, 1985.

Fall Meeting of the Metallurgical Society (Materials Week), Detroit, MI, September 16 - 20, 1984.

Invited Presentations

"Validation and Verification: A Systematic Approach With Assessment of Margins and Reliability", Defense Technology Engineering Seminar, Lawrence Livermore National Laboratory, June 2004.

"ASCI V&V Support for STS Weaponization", Tri-Laboratory Conference on Computational Modeling, Albuquerque, NM, October 2001.

“Grain Size Effects for the Polycrystals Yield Surface in Strain Gradient Plasticity”, 1999 ASME Mechanics and Materials Conference: Symposium on Gradient Plasticity and its Applications, Virginia Polytechnic Institute and State University, Blacksburg, VA, June 1999.

”Simulation of Scale-Dependent Hardness of Stamping of Single Crystals”, Thirteenth U. S. National Congress of Applied Mechanics: Symposium on Plasticity in Manufacturing Processes & Product Performance, University of Florida, Gainesville, FL, June 1998.

“The Role of Microstructure in Homogenized Descriptions of the Continuum Yield Surface”, Engineering Analysis Seminar/Information Series, Lawrence Livermore National Laboratory, June 1998.

"The Role of Two-Point Correlation Functions for Microstructure in Predictive Models of Polycrystalline Plasticity", Workshop on the Mathematics and Physics of Heterogeneous Materials, The University of Utah, Salt Lake City, UT, July 1997.

"Bounds to the Effective Yield Behavior of Materials with Random Microstructure", TMS Fall Meeting (Materials Week 1995): Toward the Design of Optimal Microstructures for Engineering Structures (Symposium), Cleveland, OH, Oct. 1995.

“Effective Yield Behavior and Homogenization for Polycrystals”, Deformation and Fracture Mechanics Working Group Seminar, Lawrence Livermore National Laboratory, June 1995.

“Yielding in Polycrystals: Improvements on Taylor’s Upper Bound Using Higher Order Statistics of the Microstructure and Comparison to Universal Upper and Lower Bounds”, Materials Science Seminar, Los Alamos National Laboratory, March 1994.

“Yielding in Polycrystals: An Improvement on Taylor’s Upper Bound”, Materials Science and Engineering Thrust Area Lecture, Lawrence Livermore National Laboratory, July 1993.

“Yielding in Polycrystals: Computation of a New Upper Bound Using Two-Point Statistics”, 4th International Symposium on Plasticity and its Current Applications, Baltimore, MD, July 1993.

“Coordinate-Free Tensorial Representations of the Orientation Distribution Function”, Seminar Series on Groups, Representations and Invariants: Applications to Microstructure and Mechanical Behavior of Materials, The Faculty of the Council of Engineering and Applied Science, Yale University, March 1992.

Contributed Presentations

"Shear Localization Studies in Aluminum Bicrystals: Misorientation and Grain Boundary Effects", 1996 ASME Mechanics and Materials Conference: Symposium on Fracture and Interfaces, The Johns Hopkins University, Baltimore, MD, June 1996.

“Orientation Imaging Microscopy: A New Tool for High Resolution Interrogation of Material Microstructure”, Imaging Sciences Workshop, Lawrence Livermore National Laboratory, November 1995.

“Grain Boundary Phenomena and Shear Localization in Aluminum Bicrystals: Correlation Between Predictive Models and Experiment”, TMS Fall Meeting (Materials Week 1995): Symposium on Forming of Sheet Materials, Cleveland, OH, October 1995.

“Effective Yield Behavior for Mixtures of Elastic/Plastic Materials, 1st International Conference on Composites Engineering, New Orleans, LA, August 1994.

“Coordinate Free Tensorial Representation of N-Point Correlation Functions for Microstructure by Harmonic Polynomials”, 10th International Conference on Texture of Materials (ICOTOM-10), Clausthal, Germany, September 1993. (This lecture was prepared by D. Sam but given by B. L. Adams due to budgetary constraints.)

“Orientation and Strain Dependence of Stored Energy of Cold Work in Axisymmetric Copper”, TMS Fall Meeting (Materials Week 1985): Symposium on Deformation Behavior, Toronto, ON, October 1985.

“X-Ray Line Broadening Characterization of Strain Inhomogeneity in Textured Copper”, TMS Fall Meeting (Materials Week 1984): Symposium on Deformation, Detroit, MI, September 1984.

Personal and Professional References

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