Liqiang Lin

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Education Background

Ph.D., Mechanical Engineering, University of Texas at San Antonio(UTSA), August, 2016
- Dissertation: The role of interfacial interactions on the mechanical behaviors of materials
- Advisor: Professor Xiaowei Zeng

M.S.E., Solid Mechanics, Zhejiang University(ZJU), March 2011

B.S., Mechanical Engineering, China Jiliang University(CJLU), July 2008

Research Area

- Material & Structural Failure Analysis
- Computational Biomechanics (bone and cell mechanics)
- Cohesive-zone FEM, Meshfree Method, MD Simulation
- Multiscale Methods and Computational Materials Science
- Structure-property Relationship in Nanocomposites
- Mechanical and Thermo-mechanical Simulations

Research Projects

1. **Multiscale Modeling of Ultrastructural Origins of Bone Fragility (funded by NSF)**, 2015-2018
Project goal: To build a multiscale cohesive finite element model to capture the mechanical behavior of bone in both ultrastructural and bulk levels and to verify the efficiency of the multiscale model in predicting the effect of ultrastructural changes on the mechanical behavior of bone using in vitro and in vivo models.

My contributions:
- Develop a multiscale methodology to investigate the structure-property relationship in biological nanocomposites (nacre or bone).
- Develop a generalized interfacial zone model to describe different interface behaviors(e.g. brittle, ductile, rubber-like, elastic-perfectly plastic behavior etc.).
- Implement the generalized interfacial zone model to model mineral-collagen interface in mineralized collagen fibrillar and organic-inorganic interface in extrafibrillar matrix for the multiscale model of lamellae.
- Investigate the effect of ultrastructural changes on the mechanical behavior of bone using in vitro and in vivo models by Abaqus.

2. **Numerical Investigation of Collective Cell Migration (funded by NIH)**, 2015-2018
Project goal: To develop a multiscale cell migration model and to elucidate how different factors control collective cell migration motions.

My contributions:

- Investigate single monocyte cell migration in fluid channel by Reproducing Kernel Particle Meshfree Method (RKPM).
- Develop a multiscale interfacial zone model to describe intercellular interaction at cell-cell junction in epithelial monolayer sheet.
- Study cell social context influence on collective cell migratory behavior by an active multiscale soft matter cell model.
- Develop a FEM simulation package by using FORTRAN90 to study the effects of intercellular strength on collective epithelial cell migration.

3. **Non-collagenous proteins vs. bone fragility (funded by NIH)**, 2014-2016

Project goal: To determine the effects of the organic interface between hydroxyapatite (HA) polycrystals on the mechanical behavior of the extrafibrillar matrix in bone and to experimentally verify the novel mechanistic model using an in vitro model.

My contributions:

- Developed a coarse-grain interfacial zone model from potential function to model interface behavior.
- Developed a novel interfacial zone model to describe different behaviors of organic interface with different hydration status (e.g. dry or wet organic interface).
- Generated the geometrical model of extrafibrillar matrix in bone by Voronoi Tessellation Method.
- Developed a FEM simulation package by using FORTRAN90 to study the effects of organic interface properties on the mechanical response of extrafibrillar matrix in bone.

Referred Journal Publications

1. M. Li, **L. Lin**, R. Guo, A.Bhalla and X. Zeng*,"Numerical Investigation of Size Effects on Mechanical Behaviors of Fe Nanoparticles through an Atomistic Field Theory", *Journal of Micromechanics and Molecular Physics*, 2(2), 1750010-1-1750010-15, 2017.

2. **L. Lin**, X.Q. Wang and X. Zeng*,"Failure analysis of C/Sic composites by cohesive FEM", *International Journal of Terraspace Science and Engineering*, 1(9), 89-95, 2017.

3. **L. Lin**, X.D. Wang and X. Zeng*,"Computational Modeling of Interfacial Behaviors in Nanocomposite Materials", *International Journal of Solids and Structures*, 115, 43-52, 2017.

4. **L. Lin** and X. Zeng*,"Computational Study of Cell Adhesion and Rolling in Flow Channel by Meshfree Method", *Computer Methods in Biomechanics and Biomedical Engineering*, 8(20), 832-841, 2017.

5. **L. Lin**, J. Samuel, X.D. Wang and X. Zeng*,"Contribution of Organic Interface in Extrafibrillar Matrix to the Mechanical Behavior of Bone Using a Novel Cohesive Finite Element Model", *Journal of the Mechanical Behavior of Biomedical Materials*, 65, 224-235, 2017.

6. **L. Lin**, X.D. Wang and X. Zeng*, "An Improved Interfacial Bonding Model for Material Interface Modeling", *Engineering Fracture Mechanics*, 169, 276-291, 2017.

7. **L. Lin**, X.Q. Wang and X. Zeng*,"The Role of Cohesive Zone Properties on Intergranular to Transgranular Fracture Transition in Polycrystalline Solids", *International Journal of Damage Mechanics*, 26(3), 379-394, 2017.

8. **L. Lin** and X. Zeng*,"Computational Modeling and Simulation of Spall Fractures in Polycrystalline Solids by an Atomistic-based Interfacial Zone Model", *Engineering Fracture Mechanics*, 142, 50-63, 2015.

9. **L. Lin**, X.Q. Wang and X. Zeng*,"Geometrical Modeling of Cell Division and Cell Remodeling by Voronoi Tessellation Method", CMES-*Computer Modeling in Engineering and Sciences*, 2(98), 203-220, 2014.

10. **L. Lin**, R. Dhanawade and X. Zeng*,"Numerical Simulations of Dynamic Fracture Growth based on a Cohesive Zone Model with Microcracks", *ASCE-Journal of Nanomechanics and Micromechanics*, B4014003:1-10, 2014.

Book Chapter Publication

1. **L. Lin** and X. Zeng*,"Computational Modeling and Simulation of Crack Growth in Polycrystalline Material with Defects by An Atomistic-based Interfacial Zone Model", *Material Modelling: Applications, Challenges and Research, Nova Science Publisher*, 2017, In press.

Conference Presentations or Proceedings

1. **L. Lin**,M. Maghsoudi-Ganjeh, X.D. Wang and X. Zeng,"Numerical Investigation of the Role of Interface Properties on Mechanical Response of Biological Nanocomposites", The 54rd Annual Technical Meeting of the Society of Engineering Science, Northeastern University, Boston, MA, July 25-28, 2017.

2. X. Zeng and **L. Lin**, "The Role of Cell-Cell Interaction on Individual and Collective Cell Behaviors in an Epithelial Monolayer", The 54rd Annual Technical Meeting of the Society of Engineering Science, Northeastern University, Boston, MA, July 25-28, 2017.

3. X. Zeng and **L. Lin**, "An Interfacial Zone Model for Intercellular Interaction Modeling in Epithelial Cells", The 14th US National Congress on Computational Mechanics (USNCCM14), Montreal, Canada, July 17-20, 2017.

4. **L. Lin**, X. Zeng and X.D. Wang,"Numerical Investigation of the Influence of Organic Interfacial Properties on the Mechanical Behaviors of Extrafibrillar Matrix in Bone", The 53rd Annual Technical Meeting of the Society of Engineering Science, University of Maryland, MD, Oct. 2-5, 2016.

5. X. Zeng and **L. Lin**,"Computational Study of Cell Migration Behaviors", The 53rd Annual Technical Meeting of the Society of Engineering Science, University of Maryland, MD, Oct. 2-5, 2016.

6. M. Maghsoudi-Ganjeh, **L. Lin**, X. Zeng and X.D. Wang,"Cohesive Finite Element Modeling of Damage Growth in Mineralized Collagen Fibril", The 53rd Annual Technical Meeting of the Society of Engineering Science, University of Maryland, MD, Oct. 2-5, 2016.

7. **L. Lin**, X. Zeng, X. Wang,"A Generalized Interfacial Interaction Model for Prediction of Mechanical Behavior in Bionanocomposite Materials", The 7th International Conference on Computational Methods, Berkeley, CA, August 1st-4th, 2016.

8. X. Zeng, **L. Lin**,"Computational Modeling and Simulation of Cell Migration",The 12th World Congress on Computational Mechanics, Seoul, Korea, July 24-29, 2016.

9. **L. Lin**, X. Wang, X. Zeng,"Bioinspired Simulation of Polycrystalline Materials", Summer Biomechanics, Bioengineering, and Biotransport Conference, National Harbor, Maryland, June 29-July2, 2016.

10. X. Zeng, **L. Lin**,"Numerical Investigation of Cell Migration", Summer Biomechanics, Bioengineering, and Biotransport Conference, National Harbor, Maryland, June 29-July 2, 2016.

11. **L. Lin**, X. Zeng, X. Wang,"The Role of Interfacial Behavior on Extrafibrillar Matrix in Bone", The 13th US National Congress on Computational Mechanics, San Diego, CA, July 26-30, 2015.

12. X. Zeng, **L. Lin**,"Computational Modeling of Collective Epithelial Cell Migration", The 13th US National Congress on Computational Mechanics, San Diego, CA, July 26-30, 2015.

13. **L. Lin**, X. Zeng, H. Xu, A. Sheldrake, J. Jiang, S. Gu and X. Wang,"Nanomechanical Behavior of Extrafibrillar Matrix in Bone",American Society for Bone and Mineral Research Annual Meeting, Houston, TX, Sept. 12-15, 2014.

14. **L. Lin** and X. Zeng,"Numerical Simulation of Intergranular/Transgranular Fracture in Polycrystalline Solids",The 17th US National Congress of Theoretical and Applied Mechanics (USNCTAM), Michigan State University, East Lansing, Michigan, June 15-20, 2014.

15. **L. Lin** and X. Zeng,"Investigation of Electromechanical Response in Ferroelectric Nanostructures", The 12th US National Congress on Computational Mechanics (USNCCM12), Raleigh, North Carolina, July 22-25, 2013.

Research/Work Experiences

UTSA – Research Scientist   Sep., 2016 to Present
- Study structure-property relationship in nanocomposites and provide a possible numerical tool for qualitatively understanding of structure-property relationships through multiscale material interface modeling.
- Propose a generalized interfacial zone model to define a variety of material interface behaviors (e.g. brittle, ductile, rubber-like, elastic-perfectly plastic behavior etc.) in nanocomposite materials.
- Develop a multiscale intercellular interaction model to investigate the effects of intercellular strength on collective epithelial cell migratory behavior.
- Develop an active multiscale soft matter cell model to investigate collective cell migration behavior.

UTSA – Research Assistant   Aug., 2012 to Aug., 2016
- Built a multiscale interfacial zone model to study the mechanical behavior of bone in both ultrastructural and bulk levels.
- Applied a multiscale cohesive zone model to study high speed induced spall fracture and intergranular/transgranular transition in polycrystalline solids.
- Investigated size effect on iron nanoparticle behavior by a multiscale continuum field theory.
- Studied single cell migration in fluid channel by a Reproducing Kernel Particle Meshfree Method (RKPM).
- Investigated the failure processes in carbon fiber reinforced ceramic composites by a coupled interfacial zone model.
- Studied the contribution of extrafibrillar matrix to the mechanical behavior of bone using a novel cohesive finite element model.
- Investigated intergranular and transgranular fracture in polycrystalline Al_2O_3 material by using an exponential cohesive zone model.
- Studied dynamic fracture growth based on a cohesive zone model with microcracks
- Performed a two-way ANOVA to determine effects of different factors on the bulk and in situ mechanical properties of bone.

Zhejiang Dahua Technology Co., Ltd – Product Design Engineer   Jan., 2012 to Aug., 2012
- Engaged in SD6C series security dome camera design (Team work).
- Assisted with DH-TD6782 series explosion-proof security dome camera maintenance.
- Computed heat dissipation in a printed circuit board installed inside D6C series security dome camera.

Hangzhou Honyar Electrical Co., Ltd – Product Design Engineer   Mar., 2011 to Jan., 2012
- Designed G series and VE series socket and switch.
- Participated in solving injection mold problem with mold tool team (Team work).

- Managed a project for improving utilization of raw plastic material.

Bosch Power Tools – Intern   Jun., 2010 to Dec., 2010
- Made a week plan for cemented carbide manufacturing.
- Assisted with the maintenance of piece-molding and manufacturing process analysis.

ZJU – Research Assistant   Sep, 2008 to Jan., 2011
- Upgraded rotary vane metering pump design.
- Engaged in pressure and vibration analysis of rotary vane metering pump.
- Simulated impact erosion of spinning rotor.

CJLU – Lab assistant   May., 2005 to Jun., 2006
- Prepared and examined metallography specimen.
- Designed and drew PCB via protel software.

Teaching Experience

- Tutor-University of Texas at San Antonio
  Finite Element Methods, Instructor: Arturo Montoya, Fall 2014

- Teaching Assistant-Zhejiang University
  Mechanics of Materials, Instructor: Hongtao Wang, Fall 2010

Major Courses at UTSA

- Advanced Systems Dynamics and Control; Advanced Thermodynamics; Finite Element Method; Advanced Solid Mechanics; Mechanical Behavior of Materials; Experimental Techniques in Engineering

Hardware and Software Skills

- **Computer Programming(5+ years experience):** Fortran, APDL, C, C++, Python
- **Software Skills(5+ years experience):** ANSYS, LS-DYNA, Abaqus, Tecplot, Solidworks, MATLAB, LAMMPS, Auto-CAD, Pro/E, VMD, Atomeye, Latex, MS-Office

Honors/Awards

Travel Awards
- Travel award from the 13th U.S. National Congress on Computational Mechanics   Jun., 2015
- Valero Travel Award   Jun., 2015
- Department of Mechanical Engineering Travel Award   Jun., 2015
- Valero Travel Award   Jun., 2014
- Graduate Student Professional Development Award   Jun., 2014
- Department of Mechanical Engineering Support   Jun., 2014

Student Awards — University of Texas at San Antonio, Mechanical Engineering
- Valero Research Excellence Award   Mar., 2015 - Dec., 2015
- National Institutes of Health funding   Sep., 2014 - May, 2016
- Graduate Research Assistant Fellowship   Sep., 2012 - Aug., 2014

- Valero Research new Ph.D Student Scholarship   Sep., 2012 - Aug., 2014

Service

Undergraduate Research and Creative Inquiry Showcase   Apr., 2017
- Judge of undergraduate at Department of Mechanical Engineering

Annual Getting Excited About Robotics Competition   Oct., 2013
- Judge of Middle School Session

International Orientation   Jan., 2013
- Assisted in helping international students and answer their questions

Peer Review Experience for Journal/Conference

- The International Conference on Functional Materials and Biomaterials

- The 6th International Conference on Biomedical Engineering and Biotechnology (ICBEB 2017)

- The 6th Global Conference on Materials Science and Engineering (CMSE 2017)

- International Journal of Terraspace Science and Engineering

- Journal of Ceramic Science and Technology

- Journal of Applied Biomaterials & Functional Materials

- PLOS ONE