

# Fatemeh (Sally) Saadat

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## PROFESSIONAL PROFILE

Postdoctoral fellow in biomedical engineering with over 4 years of experience in solid and structural mechanics and over 6 years of interdisciplinary research experience in designing, characterizing and modeling of mechanical systems and biological tissues using analytical and finite element analysis.

## RESEARCH INTERESTS

Multi-scale structural and mechanical modeling, orthopedic and tissue biomechanics, solid and continuum mechanics, functionally graded and composite materials, interfaces and adhesion, robotics, control morion, neuroscience, rehabilitation, biomedical signal and image processing, motor control and neural disorders.

## EDUCATION

*Doctor of Philosophy, Mechanical Engineering and Materials Science* **August 2016**  
Washington University in St. Louis, Saint Louis, MO 63130,USA  
GPA 4.0/4.0  
Thesis: Cross-scale modeling of functional grading in musculoskeletal tissues  
Advisors: Profs. Guy M. Genin, Stavros Thomopoulos and Victor Birman

*Master of Science, Mechanical Engineering* **April 2012**  
New Mexico State University, Las Cruces, NM 88003,USA  
GPA 4.0/4.0  
Thesis: Microstructure and Mechanical Properties of Cortical Bone  
Advisors: Dr. Igor Sevostianov

*Bachelor of Science, Mechanical Engineering* **July 2007**  
Shiraz University, Shiraz, Iran  
Thesis: Finite Element Analysis of Hyper Elastic Material with Application on the Plantar Fascia Under Stretch  
Advisor: Prof. Mohammad Hasan Kadivar

## BACKGROUND AND COMPUTER PROGRAMMING SKILLS

- Strong background in solid and structural mechanics including theoretical modeling and analysis of multi-scale and functionally graded systems, nonlinear solid systems, attachment of dissimilar materials, composite structures and materials, stress concentration analysis using both analytical and finite element analysis
- Ability to apply physical principles to the understanding of structure-processing-property relationships of mechanical component and biological systems
- Strong background in continuum biomechanics with experience in mechanical characteristics of living tissue and biomineralized materials
- Strong background in homogenization techniques and calculation of effective mechanical properties of inhomogeneous materials
- Proficiency in Engineering Programs: Solid Works, ANSYS, MathCAD, Mathematica, MATLAB, Microsoft Office, Abaqus, Comsol, LabView, LaTeX
- Mechanical Testing Techniques: Load Frames (Instron)

## PROFESSIONAL AND ACADEMIC EXPERIENCE

### Postdoctoral Fellow

- Sensory Motor Performance Program, Rehabilitation Institute of Chicago (RIC), Chicago, IL (2016-present)
- Department of Physical Medicine and Rehabilitation, Northwestern University Feinberg School of Medicine, Chicago, IL (2016-present)

### Graduate Researcher

- The structure and function of the tendon-to-bone insertion site, Washington University in St Louis, Saint Louis, MO (2012-2016)
- Developed a theoretical model to investigate the role of functional grading of chondrons on nutrient transport and mechano-signalling, Washington University in St Louis, Saint Louis, MO (2015-2016)
- Allometry study “Allometric Scaling Laws for Graded Attachment of Tendon to Bone”, Washington University in St Louis, Saint Louis, MO (2014)
- Developed a novel theoretical method using homogenization theories to estimate the effective properties of composites containing a high volume fraction of different inclusion types, Washington University in St Louis, Saint Louis, MO (2013)
- The multiscale characterization and modeling of the structure, composition and mechanical properties of bone, New Mexico State University, Las Cruces, NM (2010-2012)
- Microstructure of cortical and trabecular bone tissue, New Mexico State University, Las Cruces, NM (2010-2012)
- Micromechanics methods and composite laminate theories, New Mexico State University, Las Cruces, NM (2010-2012)

### Undergraduate Research

- Finite element method and finite element modeling of structures, Shiraz University, Shiraz, Iran (2007)
- Design of a centrifuge seeder system, Shiraz University, Shiraz, Iran (2006)
- Design of mechanism for loosening and tightening of screws on the wheels of automobiles, Shiraz University, Shiraz, Iran (2005)

### Teaching Assistant and Lab Instructor

- Taught “Fluid Mechanics Lab I” at Mechanical Engineering and Material Science Department, Washington University in St Louis, Saint Louis, MO (2013-2014)
- Taught “Fluid Mechanics” at Mechanical Engineering and Material Science Department, Washington University in St Louis, Saint Louis, MO (2012)
- Taught “Experimental Methods I” at Mechanical and Aerospace Engineering Department, New Mexico State University, Las Cruces, NM (2011-2012)
- Taught “Vibrations” at Mechanical Engineering Department, Shiraz University, Shiraz, Iran (2007-2008)

### Mechanical Engineer Intern

Green Company, Shiraz, Fars, Iran

- Designed pressure vessels

**July-September 2006**

### Adjunct Lecturer

- Taught “Physics” at National Organization for the Development of Exceptional Talents, Shiraz, Iran

**2006**

## PROFESSIONAL SOCIETY MEMBERSHIPS

- A member of Society of Engineering Science (SES), Student Affiliate

**2014-2015**

- A team member of IDEA Labs: Innovation, Design, & Engineering in Action, Washington University in Saint Louis, USA **2013-2014**
- A team member of Innovation Group in Mechanical Engineering Department, Shiraz University, Iran **2003-2005**

## HONORS AND AWARDS

- Brinson Foundation Postdoctoral Fellowship, Rehabilitation Institute of Chicago, 2016-2018
- IBBM fellowship award, Summer Course, Park City, Utah, 2016
- NIH travel award, ASME 2015 4th Global Congress on NanoEngineering for Medicine and Biology, Minneapolis, MN, April 19-22, 2015
- NSF travel award, SES 51st Annual Technical Meeting, Purdue University, West Lafayette, IN, October 1-3, 2014
- NMSU Honor graduate student, 2012
- Honored for ranking among the top 0.5 % among total 450,000 participants in the National University Entrance Examination for B.Sc., 2002

## SERVICE

- Reviewer, IMECE 2016-66458, International Mechanical Engineering Congress and Exposition
- Reviewer, Materials Research Society Proceedings
- Reviewer, ASME Journal of Biomechanical Engineering
- Secretary of Iranian student organization, NMSU, USA **2011**
- A member of organizing committee of the Ninth Fluid Dynamics conference, Shiraz, Iran **2005**

## SELECTED COURSEWORK

Intermediate Biomechanics, Mechanics of Continua, Orthopaedic Biomechanics-Bones and Joints, Interfaces and Attachments in Natural and Engineered Structures, Fracture Mechanics, Microstructure and Properties of Bone, Micromechanics, Dynamics, Vibration, Elasticity, Fluid Mechanics, Automatic Control

## PUBLICATIONS

### *Journal Papers*

- F. Saadat, Victor Birman, Stavros Thomopoulos, Guy M. Genin, Functionally Grading of the Pericellular Region of a Chondron, *in preparation*.
- F. Saadat, Alix C. Deymier-Black, Victor Birman, Stavros Thomopoulos, Guy M. Genin, The Concentration of Stress at the Rotator Cuff Tendon-to-Bone Attachment Site is Conserved Across Species, *Journal of the Mechanical Behavior of Biomedical Materials*, 62, 24-32, 2016.
- F. Saadat, Victor Birman, Stavros Thomopoulos, Guy M. Genin, Effective Elastic Properties of a Composite Containing Multiple Types of Anisotropic Ellipsoidal Inclusions, with Application to the Attachment of Tendon to Bone, *Journal of Mechanics and Physics of Solids*, 82, 367-377, 2015.
- L Salguero, F. Saadat, I. Sevostianov, Micromechanical Modeling of Elastic Properties of Cortical Bone Accounting for Anisotropy of Dense Tissue, *Journal of Biomechanics*, 47 (13), 3279-3287, 2014.
- F. Saadat, I. Sevostianov, A. Giraud, Approximate Representation of a Compliance Contribution Tensor for a Cylindrical Inhomogeneity Normal to the Axis of Symmetry of a Transversely Isotropic Material, *International Journal of Fracture*, 174 (2), 237-244, 2012.

### *Conference Papers and Abstracts*

- Guy Genin, Behzad Babaei, John Boyle, Alix Deymier-Black, Yizhong Hu, Justin Lipner, Fatemeh Saadat, Victor Birman, Stavros Thomopoulos. Multiscale modeling of partially mineralized tissues. Paper NEMB2015-8120. ASME 2015 4th Global Congress on NanoEngineering for Medicine and Biology, Minneapolis, MN, April 19-22, 2015.
- Fatemeh Saadat, Alix C. Deymier-Black, Victor Birman, Stavros Thomopoulos, Guy Genin. Allometric Scaling of Mineral Gradations for Constant Stress at the Tendon-to-Bone Insertion. NEMB2015-8015. ASME 2015 4th Global Congress on NanoEngineering for Medicine and Biology, Minneapolis, MN, April 19-22, 2015.
- F Saadat, V Birman, S Thomopoulos, GM Genin. Functional Grading of Chondrons. IMECE2015-52591. ASME 2015 International Mechanical Engineering Congress & Exposition, Houston, Texas, November 13-19, 2015.
- F Saadat, V Birman, S Thomopoulos, GM Genin. Estimates of the effective stiffness of a composite containing multiple types of inclusions. SES 51st Annual Technical Meeting, Purdue University, West Lafayette, IN, October 1-3, 2014.

## SELECTED PRESENTATIONS

- Fatemeh Saadat, Cross-scale modeling of functional grading in musculoskeletal tissues. Seminar Talk at Rehabilitation institute of Chicago. Chicago, IL. May 5th, 2016.
- Fatemeh Saadat, Cross-scale structure-function relationship at rotator cuff tendon-to-bone attachment, invited talk at Hand Research laboratory at Cleveland Clinic, Lerner Research Institute, Cleveland, OH. April 25th, 2016.
- Fatemeh Saadat, Alix C. Deymier-Black, Victor Birman, Stavros Thomopoulos, Guy Genin, The stress concentration is conserved at rotator cuff tendon-to-bone attachment site across species, Poster Presentation at the 21st Annual Graduate Research Symposium, St Louis, MO. Feb 23, 2016.
- Fatemeh Saadat, Alix C. Deymier-Black, Victor Birman, Stavros Thomopoulos, Guy Genin, Allometric Scaling of Mineral Gradations for Constant Stress at the Tendon-to-Bone Insertion. NEMB2015-8015. ASME 2015 4th Global Congress on NanoEngineering for Medicine and Biology, Minneapolis, MN, April 19-22, 2015.
- FS. Saadat, S. Thomopoulos, V. Birman, GM Genin, Multiphase Elastic Homogenization, and the Mechanics of Tendon-to-Bone Attachment, Proceedings of the Society of Engineering Science 51st Annual Technical Meeting, West Lafayette, Purdue University, 2014.
- F. Saadat, S. Thomopoulos, V. Birman, G. Genin, Effective Elastic Properties of a Composite Containing Multiple Types of Anisotropic Ellipsoidal Inclusions, Proceedings of the Society of Engineering Science 51st Annual Technical Meeting, West Lafayette, Purdue University, 2014.
- G. Genin, J Boyle, A Demyier-Black, Y Hu, J Lipner, FS. Saadat, A. Schwartz, S. Thomopoulos, V. Birman, Tendon-to-Bone Enthesis as a Structured Nanomaterial, Proceedings of the Society of Engineering Science 51st Annual Technical Meeting, West Lafayette, Purdue University, 2014.
- Stavros Thomopoulos, Victor Birman, Markus J. Buehler, Ioannis Chasiotis, Mark Anastasio, Pedro Ponte-Castaeda, Asa H. Barber, Alix C. Deymier-Black, John C. Boyle, Baptiste Depalle, Pavan V.B. Kolluru, Yizhong Hu, Zhao Qin, Fatemah Sadaat, Andrea G. Schwartz, Guy M. Genin, Multi-scale mechanics of the tendon-to-bone attachment. Poster Presentation at the 2014 Multiscale Modeling (MSM) Consortium Meeting, Interagency Modeling and Analysis Group (IMAG), NIH Campus, Bethesda, MD, September 3-4, 2014.
- FS. Saadat, Igor Sevostianov, Microstructure and Mechanical Properties of Cortical Bone, Biomineralization Group, Washington University, St Louis, MO, 2013.
- F. Saadat, L Salguero, I. Sevostianov, Microstructure and Mechanical Properties of Cortical Bone, Poster presentation at Women in Engineering at New Mexico State University, New Mexico, Las Cruces, 2011.