

# Nabiollah Abolfathi

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## EDUCATION

- PhD in Mechanical Engineering** May. 2009  
North Dakota State University, Fargo, ND  
GPA: 4.0/4.0
- Dissertation: Micromechanics Characterization and Analysis of Brain Tissue
- Master in Mechanical Engineering** Aug. 1998  
Sharif University of Technology, Tehran, Iran
- Theses: Design and Manufacturing of a six-axis force sensor
- Bachelor in Mechanical Engineering** Sep. 1996  
Sharif University of Technology, Tehran, Iran
- Theses: Design and Manufacturing of a modular conveyor for robotic applications

## ACADEMIC ACHIVMENTS

### **Research Experience:**

Full time faculty member of Biomedical Engineering department in Amir Kabir University of technology  
Involved with research projects (in progress) on:

- Design and fabrication of a DC-Motor actuated valve less micro pump for Lab-on-a-chip application.
- Design criteria and optimization of a two valve piezoelectric micro pump.
- Design and prototype fabrication of a novel polymer based bio-microchip for cell adhesion measurement.
- Design and fabrication of a wax based micro actuator for cell stimulation.
- Design a low cost mechanical testing machine for soft tissue test and experiments.
- Design and fabrication of a disposable micro pump for insulin delivery.
- Design and prototype manufacturing of a low cost blood cell counter for rapid diagnostic application.
- A micro-needle array fabrication for painless vaccine delivery.
- MD simulation of CNTN protein involved in axon-ECM adhesion in CNS tissue.
- Brain tissue modeling with random fiber distribution for axon failure criteria.
- Introducing the first mechanical modeling for brain tissue post injury phenomenon.

Research Assistant in Micromechanics and Multiscale Modeling Lab, Department of Mechanical Engineering North Dakota State University, Fargo, ND, Involved with research projects on:

- Head/Brain modeling and brain injury analysis in micro/macro-scale using FEM analysis with LS DYNA, HYPERMESH and ABAQUS
- Blast modeling for the shock-wave interactions with human head using ALE method
- Characterization procedure for linear and non-linear tissue material properties under static, creep, and dynamic loading
- Development of a Multiscale algorithm for load transfer analysis of brain tissue and brain cell elements
- Cell modeling for impact analysis using combined structural and continuum model in LSDYNA
- Diffuse axonal injury characterization for degraded brain tissue
- Cell and ECM adhesion modeling method for Brain tissue using CZM method
- Multiscale composite engineering analysis, micromechanics composite characterizations

Research Assistant in Mechatronic, Robotic and simulation Lab, Department of Mechanical Engineering Sharif University of Technology, Tehran, Iran. Involved with research projects on:

- Optimization method on structure design with application in sensor design
- Six-axes force/torque sensor design and manufacturing for robotic application

#### **Journal Articles Published/ under Review:**

1. Abolfathi N., Naik A., Sotudeh M., Karami G. and Ziejewski M. “A micromechanical procedure for characterization of the mechanical properties of brain white matter” *Computer Methods in Biomechanics and Biomedical Engineering*, 2008 (in press, available online, DOI: 10.1080/10255840802430587).
2. Abolfathi N., Karami G. and Ziejewski M. “Biomechanical cell modeling under impact loading” *International Journal of Modeling and Simulation*, 28 (2008) 4, 4877-82
3. Abolfathi N., Naik A., Karami G. and Ziejewski M. “A Micromechanical Characterization of Angular Bidirectional Fibrous Composites” *Computational Materials Science*, 43 (2008) 1193–1206
4. Naik A., Abolfathi N., Karami G. and Ziejewski M. “Micromechanical Viscoelastic Characterization of Fibrous Composites” *Journal of Composite Materials*, 42 (2008) 1179-1204
5. Karami G., Grundman N., Abolfathi N. and Naik A., “Thermoelastic Characterization and Evaluation of Residual Stresses in Bi-Directional Fibrous Composites” *Applied Composite Material*, 15 (2008) 259–272
6. Karami G., Grundman N., Abolfathi N., Naik A., and Ziejewski M. “A Micromechanical Hyperelastic Modeling of Brain white matter under large deformation” *Journal of the Mechanical Behavior of Biomedical Materials*, 2008 (in press, available online, DOI: 10.1016/j.jmbbm.2008.08.003).
7. Sotudeh M., Karami G., Ziejewski and Abolfathi N. “Biomechanical Analysis of Primary Blast-Related Brain Injury” *ASME Journal of Biomedical Engineering*, 2008 (under review).
8. Abolfathi N., Naik A. and Karami G. “Interfacial Adhesion Influence on Mechanical Property of Fibrous Composite using Micromechanics Analysis”, *Interaction and Multiscale Mechanics*, 2008 (under review).

## **Conference Papers and poster published/ presented:**

1. Abolfathi N., Karami G. and Ziejewski M. “Cell modeling under impact loading - Combined tensegrity and continuum modeling”, *ASME International Conference 2006* Chicago.
2. Abolfathi N., Naik A., Karami G. and Ziejewski M. “Micromechanical Analysis of a tissue- the effect of cell adhesion to extra cellular matrix”, *ASME Bioengineering Conference, SBC 2007*, Keystone, Colorado.
3. Abolfathi N., Naik A., Karami G. and Ziejewski M. “Micro-biomechanical Characterization of Wavy Axons in Brain Tissues”, *Second International Conference of Mechanics of Biomaterials and Tissues 2007*, Lihue, Hawaii.
4. Naik A., Abolfathi N., Karami G. and Ziejewski M., “Micromechanical Viscoelastic characterization of composites”, *International Symposium in Plasticity 2007*, Alaska.
5. Karami G., Ziejewski M. and Abolfathi N. “an introduction to Multiscale modeling of brain tissue” *Multiscale and functionally graded material conference, 2006*, Hawaii.
6. Abolfathi N., Naik A., Sotudehchafi M., Karami G. and Ziejewski M. “Diffuse Axonal Injury and Degradation in Mechanical Characteristics of Brain White Matter”, *ASME Bioengineering Conference, SBC 2008*, Marco Island, Florida.
7. Abolfathi N., Naik A, Karami G and Ziejewski M “Brain Tissue Modeling and Load Transfer Characteristics of Axons”, *Inaugural International Mechanics Institute Conference 2008, (EM08)*, Minneapolis, Minnesota.
8. Abolfathi N., Naik A., Karami G. and Ziejewski M. “Adhesion Influence in Load Transferring of Axons Embedded in Extra Cellular Matrix (ECM) in Brain Tissue” *Inaugural International Mechanics Institute Conference 2008, (EM08)*, Minneapolis, Minnesota.
9. Sotudehchafi M., Abolfathi N., Karami G. and Ziejewski M. “A Multi-scale Finite Element Model for Shock Wave-induced” *ASME Bioengineering Conference, SBC 2008*, Marco Island, Florida.
10. G. Karami, N. Grundman, N. Abolfathi, A. Naik, and M. Ziejewski “ Analysis of brain white matter for large deformation using micromechanics method
11. Vossoughi G.R., Karegarnovin M.H. and Abolfathi N., “An optimal design strategy for six- axis force sensor” 4th ISME. International conference 2000, Tehran.

## **Contribution to Proposal Development:**

1. “Blast and the Consequences on Traumatic Brain Injury- Multiscale Mechanical”, ND DEPSCoR 2006, Modeling of Brain, 04/01/07-03/31/10, Funded by AFSOR. (PI, G. Karami)
2. “Multi-element Cell Model and ALE Finite Element for Cell-Matrix Adhesion”, submitted to NSF, Cellular Systems Cluster (PI. G. Karami).
3. Head-Helmet Interactions and the Biomechanics of Traumatic Brain Injury under Blast Overpressure Waves, 2008, Department of Defense Congressionally Directed Medical Research Programs, (PI, G. Karami)

## **PROFESSIONAL TRAININGS**

- Advance impact and crashworthiness training course LSTC 2008, Dearborn, USA
- ALE and fluid/Structure Coupling training course LSTC 2006, Dearborn, USA
- Process design for body shop WOOSHIN Co., South Korea
- Geometry tolerance development for machine design TAM Co., Iran
- Equipment design for body shop WOOSHIN Co., South Korea
- New concepts in high speed roller conveyors FATA Co., Italy
- Engineering software: CATIA, MDT, ANSYS, TAM Co., Iran
- Pneumatic and Electropneumatic elements and circuit design. FESTO Co., Germany
- Geometry improvement methods and quality assurance of in automotive body shop plants IKCO Co., Iran
- Ergonomic equipment designs TAM Co., Iran
- Quality management concepts TAM Co., Iran

## **ENGINEERING EXPERIENCE**

### **Project Manager, Process Engineer, Design Engineer:**

Sep. 1999 - Sep. 2004

Advanced manufacturing in automotive industry (TAM Co.), automatic production line manufacturer for automotive industry.

- Project manager of underbody line for new Peugeot 206 factory working with FATA (Spain), FATA (Italy), EDAG/ FFT (Germany), automatic transportation and buffer system for X7 project working with WOOSHIN (South Korea)
- Process design engineer for line process lay out, welding point, standard equipment, robot and robotic gun selection, line simulation and efficiency calculation
- Design engineer of equipment for body shop such as jigs, fixtures,
- Design engineer of automatic transfer system such as electrical mono rail system and power and free conveyors
- Design engineer of special machines for transportation, inspection and buffering of car body in body shop

### **Design and Manufacturing Engineer:**

Sep. 1998-Sep. 1999

Sazeh Yadak Sahar (SYS Co.), automotive manufacturer parts

- Feasible study to develop of new products and improvement of old products
- Design engineer and supervisor for manufacturing of testing machine including durability, performance, leakage and calibration test
- Designer and supervisor for manufacturing of production equipment for assembly line of new thermostat for PRIDE ( a model from KIA company )

### **Design and Manufacturing Engineer:**

Dec. 1996 – Sep.1998

JTS R&D Center, Industrial Research and Development Center- part time,

- Industrial research dealing with car parts manufacturers
- Design engineer and supervisor for manufacturing of friction test machine and ~~for~~ rubber laboratory
- Design engineer and manufacturing supervisor of test machine for motorcycle shock absorber
- Design engineer and manufacturing supervisor of assembly line equipment

## **INDUSTRIAL RESEARCH**

- Modeling of a car body assembly line and fixtures for variation validation and reliability. TAM Co. & FATA Co. Jul.2003-Nov.2003
- Modeling of thermal actuators and sensors responses for a specific automotive engine: SYS Co. (Sazeh Yadak Sahar Co.), Oct. 1997 – Nov. 1998
- Modeling of motorcycle shock absorber JTS R&D Center, Jan.1997-Aug.1997
- Modal analysis of X7 prototype car: JTS R&D Center, Jan1997- Aug. 1997
- Complete dynamic simulation and analyze to improve stability of old production of a specific model of minibus (IVECO - Iran). JTS R&D Center, Jan. 1997- Aug. 1997

## **HONORS**

- Student Researcher of the Year at College of Engineering, North Dakota State University, 2008
- Student Researcher of the Year Mechanical Engineering Department, North Dakota State University, 2008
- 8<sup>th</sup> in the nationwide university entrance exam for Master degree (first in the mathematics division ),1996
- Rank 219<sup>th</sup> in overall nationwide university entrance exam among 1200,000 students, 1992
- Selected to the top 42 competitors for final stage of the International Mathematical Olympiad: 1990-1991

## **PROFESSIONAL MEMBERSHIP**

- Member of ASME student chapter
- Member of EMBS student chapter
- Member of SMTA student chapter ( vice president of organization on 2006-7)
- Member of ASE

## **ENGINEERING SOFTWARE AND COMPUTER SKILLS**

Have worked and experienced in the following Finite Element software and engineering pre- and post processors packages

ABAQUS	LSDYNA	HYPER-MESH	ANSYS	ATB
CATIA	PRO/E	SOLIDWORKS	MDT	AutoCAD
MATLAB	MS-OFFICE			

## REFERENCES

- **Ghodrat Karami** (Adviser), Professor E-mail: g.karami@ndsu.edu
- **Mariusz Ziejewski** (Adviser), Professor E-mail: mariusz.ziejewski@ndsu.edu
- **Alan Kallmeyer**, Professor and Chair E-mail: Alan.Kallmeyer@ndsu.edu

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