

# REZA RABIEI, PhD

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## EDUCATION

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### PhD, Mechanical Engineering

Sep. 2007 – May 2011

McGill University, Montreal, GPA: 4.0/4.0

Dissertation: Deformation and Fracture of Mineralized Biological Materials

Committee: Francois Barthelat (advisor), Pascal Hubert, Rosaire Mongrain

### M.Sc., Mechanical Engineering

Sep. 2004 – Feb. 2007

Iran University of Science and Technology, Tehran, Iran, GPA: 3.74/4.0

Dissertation: Optimum design of composite laminates for frequency constraints

Committee: Behrooz Farshi (advisor), Mahmood Shokriyeh

### B.Sc., Mechanical Engineering

Sep. 2000 – Sep. 2004

Tehran Polytechnic, Tehran, Iran, GPA: 3.63/4.0

Dissertation: Mechanical properties of shape memory alloy implants

Supervisor: Ali Sadoogh Vanini

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## AWARDS AND HONORS

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- **Best Poster Presentation Award** at BMESS Symposium (September 15, 2011, Montreal, Canada): “Toughness amplification in natural composites”.
- **GREAT Travel Award**, Graduate and Postdoctoral Studies, McGill University, 2011.
- **Student Award of Exceptional Work Quality**, English and French language centre, McGill University, 2010.
- **Best Paper by a Young Researcher**, awarded at the 12th International Congress on Fracture (July 12-17, 2009, Ottawa, Canada): “Micromechanics of fracture in nacre from mollusk shells”. F. Barthelat and R. Rabiei.
- **Ranked 150<sup>th</sup>** in Nation-Wide Entrance Examination for Graduate Studies in Applied & Solid Mechanics among around 12,000 participants, Iran, 2004.
- **Selected as Elite** and Awarded the permission to take courses in Industrial Engineering, Industrial Department of Tehran Polytechnic, Tehran, Iran, 2002.
- **Ranked 468<sup>th</sup>** in Nation-Wide Entrance Examination for Undergraduate Studies in Physics & Mathematics among around 400,000 participants, Iran, 2000.
- **Selected and Honored** in National Mathematics Olympiad (provincial level), Iran, 1999.

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## JOURNAL ARTICLES

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- R. Rabiei, F. Barthelat. “Deformation and fracture in sheet and columnar nacre.” In preparation.
- S. Bekah, R. Rabiei, F. Barthelat. “Structure, Scaling and Performance of Natural Micro- and Nanocomposites.” *BioNanoScience* 1 (1-2), p.53-61, 2011.
- F. Barthelat, R. Rabiei. “Toughness amplification in natural composites.” *Journal of the Mechanics and Physics of Solids* 59: 829-840, 2011.
- R. Rabiei, S. Bekah, F. Barthelat. “Failure mode transition in nacre and bone-like materials.” *Acta Biomaterialia* 6: 4081-4089, 2010.

- B. Farshi, R. Rabiei. "Optimum design of composite laminates for frequency constraints." *Composite Structures* 81(4): 587-597, 2007.

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## CONFERENCES

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- R. Rabiei, S. Bekah, F. Barthelat. "Failure mode transition in natural mineralized composites." *MRS Proceedings* 2011, 1301, mrsf10-1301-oo01-11 doi:10.1557/opl.2011.564.
- R. Rabiei, S. Bekah, F. Barthelat. "Deformation and Failure Mode Transition in Hard Biological Composites." *Conference Proceedings of the Society for Experimental Mechanics Series* 2011, Volume 15, 365-372, DOI: 10.1007/978-1-4419-9794-4\_51.
- R. Rabiei, F. Barthelat. "Toughness amplification in natural composites." poster presentation, *MRS* 2010, Boston, MA.
- R. Rabiei, S. Bekah, F. Barthelat. "Failure mode transitions in nacre and bone-like materials." *ASME IMECE* 2010, Vancouver, BC.
- A. Dastjerdi, R. Rabiei, F. Barthelat. "Interaction of cracks with osteons and cement lines in cortical bone." Poster presentation, *Conference on Human Cell Transformation* 2010, Montreal, QC.
- F. Barthelat, J. Poissant, R. Rabiei, A. Dastjerdi. "Applications of the subset splitting digital image correlation (SSDIC) method in fracture mechanics." *Society for Experimental Mechanics Annual Conference* 2010, Indianapolis, IN.
- F. Barthelat, R. Rabiei. "Micromechanics of fracture in nacre from mollusk shells." *12th International Conference on Fracture (ICF12)* 2009, Ottawa, ON.
- F. Barthelat, R. Rabiei. "Micromechanics of fracture in sheet and columnar nacre." *Society for Experimental Mechanics - SEM Annual Conference and Exposition on Experimental and Applied Mechanics* 2009, v 3, p 1564-1566.
- R. Rabiei, S. Bekah, F. Barthelat. "Structure, deformation and fracture of different types of nacles." *ASME International Mechanical Engineering Congress & Exposition* 2008, Boston, MA
- F. Barthelat, R. Rabiei. "The Deformation and Fracture of Nacre-Mother of Pearl." *Society for Experimental Mechanics Annual Conference* 2008, Orlando, FL.
- R. Rabiei, B. Farshi. "Vibrational optimization of composite plates." *ISME* 2007, Tehran, Iran.
- R. Rabiei, Y. Radparvar, A. Farzadi. "Project non-conformity management through a regional approach." *Proc. Hydro Int. Conf.* 2006, Porto Carras, Greece.

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## BOOK CHAPTERS

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- Invited book chapter: "Nacre from mollusk shells: inspiration for high-performance nanocomposites" to appear in *Natural Polymer Nanocomposites*, publisher: *Royal Society of Chemistry*.
- Summaries of concepts of mechanical engineering, admission exam for graduate studies in Iran, Rah-Pooyan Sharif Publication, Tehran, Iran, 2005.

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## INVITED TALKS

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- "The Deformation and Fracture Mechanisms of Hard Biological Materials" *Chemistry Department, McGill University, Montreal QC, March 1st 2010.*
- "The mechanical performance of sheet and columnar nacre" *1st Biomimetic Symposium, McGill University, Montreal QC, October 31st 2008.*

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## EMPLOYEMENT

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### **Postdoctoral Fellow (full-time)**

(July 2011 – Present)

Biomimetics laboratory, McGill University, Montreal, Canada  
Supervisor: Prof. Francois Barthelat

- Worked on mechanics of miniature porous screws used for scaphoid bone fracture treatment (co-supervised by Dr. Paul Martineau, Montreal General Hospital).
  - Investigated interface properties of natural mineralized composites such as nacre and bone.
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### **Biomimetics Lab Manager (part-time responsibility)**

(Sep 2008 – Present)

Biomimetics laboratory, McGill University, Montreal, Canada  
Supervisor: Prof. Francois Barthelat

- Responsible for installation and maintenance of the Biomimetics lab equipments including Atomic Force Microscope, miniature loading stage, precision diamond saw, optical microscope, and polisher machine.
  - Troubleshoot lab equipments several times successfully.
  - Trained new users and students to use the lab equipments (more than 80 training sessions).
  - Supervised six undergraduate and one graduate student throughout their experimental projects.
  - Responsible for purchasing lab consumables from different suppliers around the world.
  - Negotiated research expenses regarding restocking as well as ordering new equipments wherever possible.
  - Administered user policies of the lab equipments (e.g. the reservation system).
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### **Research Assistant (full-time)**

(Sep 2007 – June 2011)

Biomimetics laboratory, McGill University, Montreal, Canada  
Supervisor: Prof. Francois Barthelat

- Characterized microstructure and mechanical performance of selected mineralized biological materials (e.g. nacre, bone and teeth).
  - Devised an experimental setup to conduct in-situ fracture experiments under Atomic Force Microscope.
  - Discovered a new failure mode in fracture behavior of some nacre species.
  - Developed several novel analytical models to explain microstructure, failure and fracture behavior of staggered composites.
  - Discovered a non-dimensional material property which controls fracture behavior of staggered structures.
  - Established new guidelines applicable to design of synthetic staggered composites (e.g. mineral platelet size and arrangement).
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### **Mechanical Engineering Expert (part-time job)**

(Oct 2004 - July 2007)

FARAB Company, Tehran, Iran  
Supervisor: Mr. M. Nadjji Moghadam

- Gained engineering expertise in standard design of hydropower plants.
- Learned the principles of Project Management from standard guidelines such as PMBOK.
- Developed an efficient algorithm to report technical conflicts within different departments of the company.

- Improved the efficiency of problem-solving procedure between the management and engineering deputies.

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**Research Assistant (full-time)**

(Sep 2004 - Feb 2007)

Iran University of Science and Technology, Tehran, Iran  
Supervisor: Prof. B. Farshi, Prof. M. Shokrieh

- Developed a numerical approach called “Modified Layerwise Optimization Algorithm” (MLOA) for optimum design of composite laminates.
- Enhanced the economy of manufacturing laminate composites by incorporating hybrid laminate design.

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**Industrial Internship**

(Jul 2004 - Sep 2004)

SIMPASH Company, Tehran, Iran  
Supervisor: Prof. A. Sadoogh Vanini

- Learned about different welding techniques as well as different coating methods used in industry.

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**Industrial Internship**

(Jun 2003 - Sep 2003)

CABLE KHODRO Company, Tehran, Iran  
Supervisor: Prof. F. Jameei

- Designed a brake mechanism for a specific type of automobile using MSC NASTRAN.

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**OTHER EXPERIENCES**

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- **Reviewer** in journal of Acta Biomaterialia.
- Completed **Graduate Teaching Workshop**, Faculty of Science, McGill University, January 2009.
- Tutored mechanical engineering students in private sessions, B.Sc. level courses (Mathematics, Statics), Tehran, Iran, 2003-2004.

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**SKILLS**

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- **Research equipment:**
  - Highly specialized in operation of Atomic Force Microscope, Loading stages, Scanning Electron Microscope, Precision Diamond Saw, Polisher Machine, Optical Microscope, Manual Milling and Machining equipment, Nanoindenter
- **Software:** MATLAB, MAPLE, ANSYS, PASCAL, SolidWorks, Working Model (2D & 3D), MSC Nastran, Microsoft Office
- **Language:** English (Fluent), French (Intermediate), Persian (Native)