

## Behrooz (Bruce) Ferdowsi, Dr. sc. ETH Zurich

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### CONTACT INFORMATION

Earth and Environmental Science, University of Pennsylvania  
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### RESEARCH INTERESTS

— Earth surface dynamics, sediment transport and fluid driven sheared granular matter  
— Behavior of granular materials and rocks across the scales  
— Earthquake triggering phenomenon (dynamic and static) and induced seismicity  
— Stick-slip dynamics at frictional interfaces  
— Computational methods: Molecular Dynamics, Discrete Element Method simulations  
— Statistical mechanics and nonlinear dynamics applied to granular materials

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### ACADEMIC AND RESEARCH EXPERIENCE

**University of Pennsylvania, Philadelphia, USA**

*Postdoctoral fellow (Earth and Environmental Science)*

**February 2015 - present**

- Sediment Transport, fluid-driven granular matter, hillslope deformation (Prof. Doug Jerolmack)
- Rock friction, granular mechanics of earthquake fault gouge (Prof. David L. Goldsby)

**National Center for Earth Surface Dynamics, Minneapolis, USA**

*Synthesis Postdoctoral fellow*

**February 2015 - present**

- Stochastic processes of sediment transport (Professors Doug Jerolmack and Chris Paola)
- Building stratigraphy grain by grain (Professors Doug Jerolmack and Chris Paola)

**University of Alberta, Edmonton, Canada**

*Researcher at Microseismic Industry Consortium*

**October 2014 - February 2015**

- Geomechanical modeling of induced seismicity and triggered failure in granular sandstones
- Hazard assessment of potentially induced seismic activities
- Increasing efficiency of hydraulic fracturing treatments

**ETH, Swiss Federal Institute of Technology, Zürich, Switzerland**

*Graduate Student and Research Assistant*

**January 2011 - October 2014**

**Tehran Polytechnic, Iran**

*Teaching Assistant*

**February 2008 - March 2010**

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## EDUCATION

### ETH, Swiss Federal Institute of Technology, Zürich, Switzerland

Doctor of Sciences (Ph.D.), Civil Engineering, January 2011 - October 2014

- Dissertation title: “Discrete element modeling of triggered slip in faults with granular gouge: application to dynamic earthquake triggering”
- My PhD project was affiliated with a large-scale research project at the Los Alamos National Laboratory (NM, USA) focused on dynamic earthquake triggering. More information:
  - <http://www.ees.lanl.gov/ees11/geophysics/nonlinear/granular.shtml>
  - <http://www.ees.lanl.gov/ees11/geophysics/nonlinear/nonlinpers.shtml>
- Advisor: Prof. Dr. Jan Carmeliet (ETH Zürich)  
Co-advisor: Dr. Michele Griffa (Empa, ETH domain)

### Tehran Polytechnic, Iran

M.Sc., Geological Engineering, 2007-2010

### University of Guilan, Iran

B.Sc., Civil Engineering, 2003-2007

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## PUBLICATIONS

8. B. Ferdowsi, M. Griffa, R. A. Guyer, P. A. Johnson, C. Marone and J. Carmeliet.  
*Acoustically-induced slip in sheared granular layers: application to dynamic earthquake triggering*  
Geophysical Research Letters, **42**(22), pp. 9750-9757, 2015.
7. B. Ferdowsi, M. Griffa, R. A. Guyer, P. A. Johnson, C. Marone and J. Carmeliet.  
*3D Discrete Element Modeling of triggered slip in sheared granular media*  
Physical Review E, **89**(4), pp. 042204(1-12), 2014.
6. B. Ferdowsi, M. Griffa, R. A. Guyer, P. A. Johnson, and J. Carmeliet.  
*Effect of boundary vibration on the frictional behavior of a dense sheared granular layer*  
Acta Mechanica, **225**(8), pp. 2227-2237, 2014.
5. P. A. Johnson, B. Ferdowsi, B. Kaproth, M. M. Scuderi, M. Griffa, J. Carmeliet, R. A. Guyer, P.-Y. Le Bas, D. T. Trugman, and C. Marone.  
*Acceleration of acoustical emission precursors preceding failure in sheared granular material*  
Geophysical Research Letters, **40**(21), pp. 5627-5631, 2013.
4. B. Ferdowsi, M. Griffa, R.A. Guyer, P.A. Johnson, C. Marone and J. Carmeliet.  
*Microslips as precursors of large slip events in the stick-slip dynamics of sheared granular layers: a discrete element model analysis*  
Geophysical Research Letters, **40**(16), pp. 4194-4198, 2013.
3. M. Griffa, B. Ferdowsi, E. G. Daub, R. A. Guyer, P. A. Johnson, C. Marone and J. Carmeliet  
*Influence of vibration amplitude on dynamic triggering of slip in sheared granular layers*

Physical Review E, **87**(1), pp. 012205(1-12), 2013.

2. M. Griffa, B. Ferdowsi, E. G. Daub, R. A. Guyer, P. A. Johnson, C. Marone and J. Carmeliet  
*Meso-mechanical analysis of deformation characteristics for dynamically triggered slip in a granular medium*  
Philosophical Magazine, **92**(28-30), 2012.

1. A. Soroush and B. Ferdowsi  
*Three dimensional discrete element modeling of cyclic undrained behavior of granular media: a micromechanical perspective*  
Powder Technology, **212**(1), pp. 1-16 , 2011.

PAPERS IN  
PREPARATION

- B. Ferdowsi, M. Houssais, C. P. Ortiz, D. Jerolmack  
*From surface to subsurface and back again: the contribution of subsurface particle motion to surface armoring*  
In preparation for PNAS (planned submission: Jan. 2016)
- B. Ferdowsi, D. Jerolmack, D. L. Goldsby  
*A granular perspective on the rate and state frictional behavior of earthquake fault gouge*  
In preparation for Review of Geophysics (planned submission Feb. 2016)
- B. Ferdowsi, C. P. Ortiz, D. Jerolmack  
*Hillslope deformation with and without external perturbations: granular physics of landscape evolution*  
In preparation for Nature Geoscience (planned submission Feb. 2016)

RESEARCH  
FUNDINGS

- Southern California Earthquake Center (SCEC), Science Collaboration Grant: “Physical controls of spontaneous and triggered slow-slip and stick-slip at the fault gouge scale”; PI: Prof. David Goldsby (Department of Earth and Environmental Sciences, Penn); Co-I: Behrooz Ferdowsi; in collaboration with Prof. Chris Marone (Dept. of Geosciences, Pennsylvania State University) for experimental observations. (\$25300, pending)

TALKS AND  
CONFERENCE  
PRESENTATIONS

- December 2015, San Francisco, USA - American Geophysical Union Fall Meeting. *Granular controls of hillslope deformation and creep* (poster)
- December 2015, San Francisco, USA - American Geophysical Union Fall Meeting. *From surface to subsurface and back again: the contribution of subsurface particle motion to surface armoring* (Invited talk)
- December 2015, San Francisco, USA - American Geophysical Union Fall Meeting. *Controls on Dune Deformation Patterns in White Sands, New Mexico* (2<sup>nd</sup> contributor to a poster by Dylan Lee, PhD student at PennSeD)
- September 2015, Palm Springs (CA), USA - Southern California Earthquake Center (SCEC) Annual Meeting, *The granular origins of rate and state friction behavior of fault gouge* (poster)
- June 2015, Clark University, USA - 13th Annual Northeastern Granular Materials Workshop. *Segregation dynamics in fluid-driven annular couette flow: contribution of subsurface processes to surface armoring in an idealized riverbed* (poster)

- May 2015, University of Delaware, USA - 2015 AMTRAK Soil to Sea Meeting. *From surface to subsurface and back again: the contribution of subsurface particle motion to surface armoring* (poster)
- January 2015, University of Alberta (Exploration Seismology, Department of Physics, Dr. Mirko van der Baan ), Canada. *Geomechanical modeling of induced seismicity* (presentation by Behrooz)
- May 2014, University of Maine (Group of acoustics and mechanics of materials, Lead by Dr. Vincent Tournat), France. *Acoustically-induced unjamming and slip triggering in sheared granular layers* (presentation by Behrooz)
- November 2013, Yale University (School of Engineering and Applied Science, The O'Hern group), USA. *DEM modeling of slip triggering in a sheared granular layer* (presentation by Behrooz)
- November 2013, Pennsylvania State University (Department of Geosciences), USA. Dynamic Triggering of Earthquakes, a seminar organized by Dr. P. A. Johnson (LANL) and Prof. C. Marone (Penn State). *DEM of a sheared bedpack* (presentation by Behrooz)
- June 2013, Ascona, Switzerland - The 18<sup>th</sup> International Conference of Nonlinear Elasticity of Materials. *MD simulation of slip triggering in sheared granular layers by boundary vibration* (presentation by Behrooz)
- February 2013, Les Houches, France - The 2<sup>nd</sup> winter school on "Materials Deformation: Fluctuations, Scaling, Predictability. *3D MD modeling of slip triggering in sheared granular layers by means of boundary vibration* (poster by Behrooz)
- October 2012, Bayreuth, Germany (University of Bayreuth) - The 17<sup>th</sup> Fall Seminar on Nonlinear dynamics. *How vibration changes the spontaneous stick-slip dynamics of a sheared granular layer* (poster by Behrooz)
- August 2012, Lausanne, Switzerland (EPFL) - CCMX Summer school on Multi scale modeling of materials. *Evolution of recurrence time and energy release during spontaneous and perturbed stick-slip dynamics of a granular layer* (presentation by Behrooz)
- July 2012, Graz, Austria (TU Graz) - The 8<sup>th</sup> European Solid Mechanics Conference. *How external vibration affects stick-slip dynamics in sheared granular layers: the micro- and meso-mechanics of dynamic earthquake triggering* (presentation by Behrooz)
- June 2012, Cefalù, Italy - The 17<sup>th</sup> International Conference on Nonlinear Elasticity in Materials. *3D molecular dynamics simulations of triggering of slip in stick-slipping, sheared granular media by means of external vibration: learned lessons for dynamic earthquake triggering* (presentation by Behrooz)
- April 2012, Vienna, Austria - European Geoscience Union (EGU) General Assembly Conference. *Meso-scale analysis of deformation patterns for dynamically triggered slip in sheared granular layers* (presentation by Dr. Griffo)
- January 2012, Les Houches, France - Winter school on "Materials Deformation: Fluctuations, Scaling, Predictability. *Deformation pattern and evolution of the internal structure of granular media during stick-slip dynamics: micromechanics of dynamic earthquake triggering* (poster by Behrooz)
- December 2011, Enschede, Netherlands (University of Twente) - invited by the Multi-Scale Mechanics (MSM) group. *Stick-slip and anisotropy of granular structure* (talk by Behrooz)
- June 2011, Cairns, Australia - Instabilities Across the Scales III. *Granular stick-slip and the micromechanics of dynamic earthquake triggering* (talk by Prof. Carmeliet)

- May 2011, Kowloon, Hong Kong (Hong Kong Polytechnic University) - The 14<sup>th</sup> Asian Regional Conference on Soil Mechanics and Geotechnical Engineering. *Study of the cyclic constant volume loading of the granular media from micromechanical aspects: effects of confining pressure and cyclic strain amplitude*
  - August 2010, London, UK (Queen Mary University of London) - The 5<sup>th</sup> International Conference on Discrete Element Method. *Effect of gradation on the constant volume cyclic behavior of granular media*
  - November 2009, Barcelona, Spain (Technical University of Catalonia; UPC) - Particles 2009. *Three dimensional discrete element modeling of undrained monotonic and cyclic response of granular media*
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#### HONORS AND AWARDS

- Award for best contribution, The 18<sup>th</sup> International Conference on Nonlinear Elasticity in Materials, Ascona (Centro Stefano Franscini of ETH Zurich) in Switzerland, June 9-14, 2013. <http://www.csf.ethz.ch/photo/csfaward/2013>; [photo](#)
  - Scholarship from Deutsche Forschungsgemeinschaft (DFG) for attending the 17th Fall Seminar on Nonlinear Dynamics at the University of Bayreuth, October 7-10, 2012.
  - Scholarship for attending the Les Houches (France) winter school on Materials Deformation: Fluctuations, Scaling, Predictability, 22-27 January 2012.
  - Swiss National Science Foundation (SNSF) fellowship for PhD studies at ETH Zürich (2011-2014)
  - 3 years fellowship for PhD studies at the University of Edinburgh (Marie Curie (EU) fellowship) (2010-2013) - Declined
  - TA/RA fellowship for PhD studies at the University of Minnesota (2010-)
  - 4 years fellowship for PhD studies at the University of Southern California (2010-2014) - Declined
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#### PROFESSIONAL AFFILIATIONS

- Regular member, Southern California Earthquake Center (SCEC), 2015-present
- Regular member, American Geophysical Union AGU, 2015-present
- Synthesis postdoctoral fellow, National Center for Earth Surface Dynamics, 2015-present
- Regular member, Swiss Geological Society, 2013-2015