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

CONTACT INFORMATION

Earth and Environmental Science, University of Pennsylvania
Sediment Dynamics Laboratory, 58A Hayden Hall
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Google scholar profile

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**

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

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 (accepted), 2015, http://dx.doi.org/10.1002/2015GL066096.

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 Nature Geoscience

— 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

— B. Ferdowsi, C. P. Ortiz, D. Jerolmack
Hillslope creep in absence and presence of external perturbations: granular physics of landscape evolution
In preparation for Nature Geoscience

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)

— 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. *Ascoustically-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 beadpack* (presentation by Behrooz)

— June 2013, Ascona, Switzerland - The 18^{th} 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^{nd} 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^{th} 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^{th} 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^{th} 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. *Mesoscopic scale analysis of deformation patterns for dynamically triggered slip in sheared granular layers* (presentaion by Dr. Griffa)

— 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, Twente, 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^{th} 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^{th} 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 montonic and cyclic response of granular media*

Honors and Awards

— Award for best contribution, The 18^{th} 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