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

CONTACT INFORMATION

Earth and Environmental Science, University of Pennsylvania
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Web profiles: Google scholar, ResearchGate

RESEARCH INTERESTS

- Computational methods for Earth systems: Molecular Dynamics and Discrete Element Method simulations
- Earth surface dynamics, sediment transport and fluid-driven/coupled granular matter
- Fault and rock mechanics and friction, earthquake triggering and induced seismicity
- Fundamental mechanisms of landscape evolution (hillslope creep, slow earthflows and landslides)
- Statistical mechanics and nonlinear dynamics applied to granular (Earth) systems

EDUCATION

ETH, Swiss Federal Institute of Technology, Zürich, Switzerland

Ph.D. (Dr. sc.), Civil and Environmental Engineering, Jan 2011 - Oct 2014

- Dissertation title: "Discrete element modeling of triggered slip in faults with granular gouge: application to dynamic earthquake triggering"
  Advisor: Prof. Dr. Jan Carmeliet (ETH Zürich)
  Co-advisor: Dr. Michele Griffa (Empa, ETH Domain)
- My PhD project was carried out in collaboration with a directed research project at the Los Alamos National Laboratory Nonlinear Geophysics department focused on dynamic earthquake triggering phenomenon.

Tehran Polytechnic, Iran

M.Sc., Geological Engineering, 2007-2010

University of Guilan, Iran

B.Sc., Civil Engineering, 2003-2007

ACADEMIC COURSE

University of Pennsylvania, Philadelphia, USA

Postdoctoral fellow (Earth and Environmental Science) **February 2015 - present**

- Fluid-driven granular matter, sediment transport, hillslope deformation (advisor: Prof. Doug Jerolmack)
- Rock friction, granular mechanics of earthquake fault gouge (advisor: Prof. David L. Goldsby)

National Center for Earth-surface Dynamics, Minneapolis, USA

Synthesis Postdoctoral fellow **February 2015 - present**

- Stochastic processes of sediment transport (advisors: Profs. Doug J. Jerolmack and Chris Paola)
- Building stratigraphy grain by grain (advisors: Profs. Doug J. 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 at Civil and Env. Eng. Dept. **January 2011 - October 2014**

University of Edinburgh, Edinburgh, Scotland, UK

Research Assistant at the Institute for Infrastructure and Environment **September 2010 - January 2011**

Tehran Polytechnic, Tehran, Iran

Teaching Assistant **February 2008 - May 2010**

ARTICLES IN REVIEW

- B. Ferdowsi, C. P. Ortiz, M. Houssais, D. J. Jerolmack
  River-bed armoring as a granular segregation phenomenon
  Proceedings of the National Academy of Sciences of the USA (in review, minor revision, Aug 2016)

PEER-REVIEWED ARTICLES

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.

MANUSCRIPTS IN PREPARATION

— B. Ferdowsi, C. P. Ortiz, D. J. Jerolmack
Creepy landscapes: the granular origins of soil transport on hillslopes
In preparation for Science (planned submission: September 2016)

— C. P. Ortiz, B. Ferdowsi, D. J. Jerolmack
Nature of the transition from creep to dense rapid flow in sheared frictional granular systems
In preparation for Nature Physics (planned submission: September 2016)

— B. Ferdowsi, D. J. 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: September 2016)

— NCED synthesis postdoc group collaborative review paper (Behrooz Ferdowsi, John D. Gartner, Kerri N. Johnson, Alan Kasprak, A. B. Limaye, Kimberly L. Miller, William Nardin, Alejandra C. Ortiz, Mariela Perignon, Alejandro Tejedor, Chris Paola (equal contributions)
Earthcasting: predicting geomorphic climate of the Earth
In preparation for Earth's future (planned submission: Early 2017)

— D. B. Lee, B. Ferdowsi, D. J. Jerolmack
Dune deformation dynamics reveal a topographic signature of life
In internal review to be submitted to 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, approved)

TALKS AND CONFERENCE PRESENTATIONS

— September 2016, Palm Springs (CA), USA - Southern California Earthquake Center (SCEC) Annual Meeting, *Physical controls of spontaneous and triggered slow-slip and stick-slip at the fault gouge scale* (poster)

— July 2016, Stonehill College, Easton (MA), USA - Gordon Research Conference and Seminar: Particulate Systems in Science and Technology. *Granular segregation in an experimental river* (GRC poster, GRS talk)

— June 2016, Université Pierre-et-Marie-Curie, Paris, France - 31^{st} edition of the Conference on Mathematical Geophysics (CMG). *Creepy landscapes: the origins and consequences of sub-threshold transport* (invited talk given by Prof. Jerolmack)

— May 2016, USGS National Center, Reston (VA), USA - 2016 River & Regolith Erosion and Deposition Summit (Amtrak club): Amtrak Soil to Sea Meeting. *Creepy landscapes: the granular origins of soil transport on hillslopes* (presentation)

— 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^{nd} 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, Worcester (MA), 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 River & Regolith Erosion and Deposition Summit (Amtrak club): 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, Université du 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, 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* (invited talk given 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*

COLLABORATORS

- Prof. Douglas J. Jerolmack, Earth and Environmental Science, University of Pennsylvania, USA.
- Dr. Carlos P. Ortiz, Earth and Environmental Science and Physics and Astronomy, University of Pennsylvania, USA.
- Dr. Morgane Houssais, Benjamin Levich Institute, The City College of New York, USA.
- Prof. Chris Paola, Department of Earth Sciences, University of Minnesota, USA.
- Prof. David L. Goldsby, Earth and Environmental Science, University of Pennsylvania, USA.
- Prof. Dr. Jan E. Carmeliet, Departments of Civil, Environmental and Geomatic Engineering (D-BAUG), Mechanical and Process Engineering (D-MAVT) and Architecture (D-ARCH), ETH Zürich, and head of the Laboratory of Multiscale Studies in Building Physics, Swiss Federal Laboratories for Materials Science and Technology (Empa, ETH-Domain), Dübendorf, Switzerland.
- Prof. Chris J. Marone, Department of Geosciences, Pennsylvania State University, USA.
- Dr. Paul A. Johnson, Leader of Nonlinear Elasticity Team and Senior Technical Staff Member, Earth and Environmental Science Division (Geophysics), Los Alamos National Laboratory (LANL), USA.
- Dr. Michele Griffa, Senior Research Scientist, Group Leader for 3D image analysis and simulation, Swiss Federal Laboratories for Materials Science and Technology (Empa, ETH-Domain), Dübendorf, Switzerland.
- Prof. Robert A Guyer, Emeritus faculty at UMass Amherst, Consultant at Earth and Environmental Science Division (Geophysics), Los Alamos National Laboratory (LANL), USA.
- Prof. Jean M. Carlson, Department of Physics, University of California Santa Barbara, USA.
- Prof. Emily E. Brodsky, Earth and Planetary Sciences, University of California Santa Cruz, USA.

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. CSF Awards 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

Selected service

- Reviewer for: NSF - Geomorphology and Land-use Dynamics, Scientific Reports, Journal of Geophysical Research - Earth Surface, International Journal of Solids and Structures, Powder Technology.
- Lecturer, Summer Institute for Earth-surface Dynamics (2015, 2016).

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

References

- **Professor Douglas J. Jerolmack**
  Associate Professor and Graduate Chair
  Department of Earth and Environmental Science, University of Pennsylvania
  Editor, Earth Surface Dynamics (http://www.earth-surface-dynamics.net/)
  154A Hayden Hall/6316, 240 S. 33rd St., Philadelphia, PA 19104, USA
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- **Professor Chris Paola**
  Professor, Department of Earth Sciences
  and
  Interim Director, St Anthony Falls Laboratory (http://www.safl.umn.edu)
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- **Professor Jan Carmeliet**
  Professor, Chair of Building Physics
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- **Dr. Paul A. Johnson**
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  Fellow, Los Alamos National Laboratory, Geophysics Group
  Earth and Environmental Sciences Division
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  email: paj@lanl.gov

- **Dr. Michele Griffa**
  Senior research scientist
  Group Leader for 3D image analysis and simulation
  Center for X-Ray Analytics
  Dept. of Civil and Mechanical Engineering
  Swiss Federal Laboratories for Materials Science and Technology (Empa), ETH domain
  Überlandstrasse 129, CH-8600, Dübendorf (Zürich), Switzerland
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