

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

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### CONTACT INFORMATION

Earth and Environmental Science, University of Pennsylvania  
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*Research homepage:* <http://behroozf.github.io>  
*Web profiles:* [Google scholar](#), [ResearchGate](#)

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### 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

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### 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

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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**

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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

9. 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 press, August 2016)
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: the spatial and temporal dynamics of Earth surface evolution*  
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<sup>st</sup> 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<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, 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. *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 beadpack* (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. 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<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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#### 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 Griffo, 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.

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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. [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
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#### 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).
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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
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#### 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/>)  
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- **Professor Chris Paola**  
 Professor, Department of Earth Sciences  
 and  
 Interim Director, St Anthony Falls Laboratory (<http://www.safll.umn.edu>)  
 University of Minnesota  
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 Tel: (+1) 612-624-8025  
 email: [cpaola@umn.edu](mailto:cpaola@umn.edu)
- **Professor Jan Carmeliet**  
 Professor, Chair of Building Physics  
 Swiss Federal Institute of Technology Zürich (ETHZ)  
 HIL E 46.2, Stefano-Franscini-Platz 5, CH-8093, Zürich Hönggerberg, Switzerland  
*and*  
 Head of the Laboratory for Building Science and Technology,  
 Dept. of Civil and Mechanical Engineering  
 Swiss Federal Laboratories for Materials Science and Technology (Empa)  
 Überlandstrasse 129, CH-8600, Dübendorf (Zürich), Switzerland  
 Tel: (+41) (0)44-633-2855 (ETHZ office); (+41) (0)58-765-4118 (Empa office)  
 email: [jan.carmeliet@empa.ch](mailto:jan.carmeliet@empa.ch); [carmeliet@arch.ethz.ch](mailto:carmeliet@arch.ethz.ch)
- **Dr. Paul A. Johnson**  
 Team Lead Nonlinear Elasticity, Senior Technical Staff Member  
 Fellow, Los Alamos National Laboratory, Geophysics Group  
 Earth and Environmental Sciences Division  
 Mail Stop D443, Los Alamos (NM), USA  
 Tel: (+1)-505-667-8936  
 email: [paj@lanl.gov](mailto: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  
 Tel: (+41) (0) 58-765-4360  
 email: [michele.griffa@empa.ch](mailto:michele.griffa@empa.ch)