

# Utkarsh Mital

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## EDUCATION

- Ph.D. in Applied Mechanics** **2016**  
California Institute of Technology  
Thesis title: “Understanding Micro- and Macro-Mechanics of Soil Liquefaction – A Necessary Step for Field-Scale Assessment
- M.S. in Applied Mechanics** **2011**  
California Institute of Technology
- B.Tech. in Civil Engineering** **2010**  
Veermata Jijabai Technological Institute

## RESEARCH INTERESTS

Hydrology, computational geomechanics, computational geosciences, machine learning

## RESEARCH EXPERIENCE

- Postdoctoral Scholar in Energy Geosciences** **April 2019 – Present**  
Lawrence Berkeley National Laboratory Berkeley, CA  
Supervisor: Dr. Carl Steefel
- Developing machine learning approaches to integrate data and high-performance watershed-scale models
- Postdoctoral Scholar in Mechanical and Civil Engineering** **July 2016 – April 2019**  
California Institute of Technology Pasadena, CA  
Advisors: Prof. Domniki Asimaki (07/2016 - 06/2017), Prof. José Andrade (07/2017 – 04/2019)
- Repurposed computer vision algorithms (CNN) to model macroscopic properties as a function of grain-scale attributes in granular materials
  - Repurposed computer vision algorithms (GANS) to model grain-scale data
  - Developed a probabilistic model of shear velocity to quantify stiffness of different terrain classes (collaboration with US Geological Survey)
  - Developed a regional map of seismic liquefaction hazard using remotely-sensed hydrological and geological data (collaboration with NASA-JPL)
  - Modeling mechanics of liquefaction in a tailings dam (sponsored by BHP)
- Graduate Research Assistant in Applied Mechanics** **June 2011 - June 2016**  
California Institute of Technology Pasadena, CA  
Advisor: Prof. José Andrade
- Simulated the mechanics of static soil liquefaction in a triaxial test. Key findings include discovery of a “warning sign” for onset of liquefaction, which can improve modeling failure of artificial slopes

- Proposed flow liquefaction as a mechanism for lower end of soil liquefaction charts. This could arm an engineer with predictive power regarding the effects of soil liquefaction in the field
- Modeled the mechanics of shear velocity of soils, to demonstrate correlations between laboratory data and field data. This could enable translating laboratory results to field conditions

### HONORS AND AWARDS

- **Second Place**, Computational Mechanics Poster Competition, Engineering Mechanics Institute Conference, Northwestern University, Evanston, IL, 2013
- **Finalist**, Modeling Inelasticity and Multiscale Behavior Student Paper Competition, Engineering Mechanics Institute Conference, Stanford University, Stanford, CA, 2015
- **People's Choice Winner** and **Second Place**, Caltech's Three-Minute-Thesis competition (<https://player.vimeo.com/video/163436530>), 2016
- Paper nominated for **ASCE Normal Medal** and **Middlebrooks Award**, 2019
- Selected by California Council on Science and Technology to present my research to California policy makers at the **California Science Translators Showcase**, 2019

### PUBLICATIONS

#### Book Chapter

- B1. Andrade, J.E. and **Mital, U.** (2019). Multi-scale and multi-physics modeling of soils. In: Lu, N., Mitchell, J., editors. *Geotechnical Fundamentals for Addressing New World Challenges*. In press.

#### Journal Articles

- J1. **Mital, U.**, Kawamoto, R. and Andrade, J.E (2019). Effect of fabric on shear wave velocity in granular soils. *Acta Geotechnica* (available online)
- J2. **Mital, U.**, Mohammadnejad, T. and Andrade, J.E. (2017) Flow liquefaction instability as a mechanism for lower end of liquefaction charts. *Journal of Geotechnical and Geoenvironmental Engineering*, 143(9): 04017065
- J3. **Mital, U.** and Andrade, J.E. (2016). Mechanics of origin of flow liquefaction instability under proportional strain triaxial compression. *Acta Geotechnica*, 11(5): 1015-1025

#### Journal Articles (submitted / in preparation)

- J4. Reid, D., **Mital, U.**, and Fourie, A. A numerical investigation of some aspects of the lateral extrusion trigger mechanism, submitted.
- J5. **Mital, U.** and Andrade, J.E. Connecting granular forces to macroscopic stress using machine learning, in preparation.
- J6. **Mital, U.**, Yong, A., Iwahashi, J., Herrick, J., and Savvaidis, A. Probabilistic modeling of  $V_{s30}$ , in preparation.

#### Conference Proceedings (peer-reviewed)

- C1. **Mital, U.**, Rajasekaran, E., Asimaki, D. and Das, N.N. (2018). Investigating the applicability of integrated hydrological modeling for mapping regional liquefaction hazard. In *Proceedings of the 5th Conference of Geotechnical Earthquake Engineering and Soil Dynamics*, Austin, TX

C2. **Mital, U.**, Andrade, J.E. and Mohammadnejad, T. (2015). Investigating the mechanical underpinnings of origin of liquefaction in field. In *Proceedings of the 6th International Conference on Earthquake Geotechnical Engineering*, Christchurch, New Zealand

#### **Conference Proceedings (not peer-reviewed)**

C3. Andrade, J.E., **Mital, U.** and Mohammadnejad, T. (2013). Micromechanical origin of static and dynamic liquefaction in granular soils. In *Proceedings of the Fifth Biot Conference on Poromechanics*, pp. 527-532, ASCE

C4. Andrade, J.E., Vlahinic, I., Lim, K.-W. and **Mital, U.** (2012). Two-scale characterization and modeling of porous continua from discrete mechanics. In *46th US Rock Mechanics/Geomechanics Symposium*. American Rock Mechanics Association

#### **INVITED TALKS**

1. Bridging length scales in granular systems using machine learning. NERSC Data Seminar Series, **Lawrence Berkeley National Laboratory**, March 29, 2019
2. Towards remote sensing data and hydrological modeling for mapping regional liquefaction hazard, Earth and Environmental Sciences Seminar, **Lawrence Berkeley National Laboratory**, March 29, 2019
3. Improving regional liquefaction hazard maps using hydrological remote sensing data: A proof of concept study at Imperial County. Invited presentation at **Seismological Society of America Annual Meeting**, Denver, CO, April 18-20, 2017
4. Mechanics of origin of liquefaction instability. Invited presentation at 5th Annual **Caltech Solid Mechanics Symposium**, Pasadena, CA, January 24, 2014

#### **CONFERENCE TALKS**

5. **Mital, U.**, Rajasekaran, E., Asimaki, D. and Das, N.N. Investigating the applicability of integrated hydrological modeling for mapping regional liquefaction hazard. Oral presentation at the 5th Conference of Geotechnical Earthquake Engineering and Soil Dynamics, Austin, TX, June 10-13, 2018
6. **Mital, U.**, Mohammadi, K., Arthur D., Andrade, J.E., and Asimaki, D. Developing an early-warning system for tailings dam liquefaction. Oral presentation at the Engineering Mechanics Institute Conference, Cambridge, MA, May 29-June 1, 2018
7. Iwahashi, J., Yamazaki, D., Matsuoka, M., Thamarux, P., Herrick, J., Yong, A. and **Mital, U.** Global terrain classification using multiple-error-removed improved-terrain (MERIT) to address susceptibility of landslides and other geohazards. Poster presentation at American Geophysical Union Fall Meeting, New Orleans, LA, Dec 11-15, 2017
8. **Mital, U.**, Kawamoto, R.Y. and Andrade, J.E. Investigating micro-mechanics of small strain elastic shear wave velocity as a metric for evaluating liquefaction resistance. Oral presentation at Engineering Mechanics Institute Conference, Stanford, CA, June 16-19, 2015
9. **Mital, U.**, Andrade, J.E. and Mohammadnejad, T. Investigating the mechanical underpinnings of origin of liquefaction in field. Poster presentation at International Conference on Earthquake and Geotechnical Engineering, Christchurch, New Zealand, November 1-4, 2015
10. **Mital, U.**, Andrade, J.E. and Galindo-Torres, S.A. Investigating micro-mechanical origin of liquefaction. Oral presentation at Engineering Mechanics Institute Conference, Evanston, IL, August 4-7, 2013

11. **Mital, U.,** Andrade, J.E. and Galindo-Torres, S.A. Investigating micro-mechanics of liquefaction. Oral presentation at Society of Engineering Science Annual Technical Conference, Providence, RI, July 28-31, 2013

### TEACHING EXPERIENCE

#### Teaching Assistant

California Institute of Technology

- Mechanics and Rheology of Porous Media
- Mechanics
- Statics and Dynamics

Pasadena, CA

Winter 2016

Spring 2015

Winter 2012

### PROFESSIONAL AFFILIATIONS (Past and present)

- American Society of Civil Engineers (Associate Member)
- Engineering Mechanics Institute
- Seismological Society of America
- Australasian Institute of Mining and Metallurgy
- American Geophysical Union

### EXTRA-CURRICULAR UNIVERSITY SERVICE

- Career Chair of Caltech Postdoctoral Association, July 2017-ongoing
- Orientation leader for International Student Orientation at Caltech, 2013-2016
- Acted/volunteered in various Caltech Theater Productions, 2013-2017
- Webmaster of Extracurricular Players at Caltech, 2014-16
- President of Organization of Associated Students of Indian Subcontinent at Caltech, 2011-12

### MEDIA COVERAGE

- <http://www.caltech.edu/news/three-minute-thesis-competition-50557>
- <http://www.mce.caltech.edu/news/844>
- <https://ccst.us/ccsts-science-translators-showcase-to-connect-california-early-career-scientists-with-members-staff/>
- <https://www.pasadenaweekly.com/2018/03/29/when-fiction-passes-as-truth-caltech-helps-the-public-see-the-difference-at-science-for-march-saturday/>

### PEER-REVIEW EXPERIENCE

- Soil Dynamics and Earthquake Engineering
- International Journal for Numerical Methods in Engineering
- International Journal of Solids and Structures
- Journal of Geotechnical and Geoenvironmental Engineering
- 5th Conference on Geotechnical Earthquake Engineering and Soil Dynamics, Austin, TX, June 10-13, 2018

### SKILLS

- **Languages:** C/C++, Python, Matlab, Mathematica
- **Engineering/Software packages:** QGIS, Keras, Pytorch, OpenMP
- **Publishing Tools:** LaTeX, EazyDraw, Jupyter notebooks

## REFERENCES

1. Carl Steefel  
Senior Scientist  
Head, Geochemistry Department  
Energy Geosciences Division  
Lawrence Berkeley National Laboratory  
[CISTeefel@lbl.gov](mailto:CISTeefel@lbl.gov)  
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2. José Andrade  
George W. Housner Professor of Civil and Mechanical Engineering  
California Institute of Technology  
[jandrade@caltech.edu](mailto:jandrade@caltech.edu)  
(626) 395-4141
3. Domniki Asimaki  
Professor of Mechanical and Civil Engineering  
California Institute of Technology  
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(626) 395-4271
4. Alan Yong  
Research Geophysicist  
U.S. Geological Survey  
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