

## A. BIOGRAPHICAL INFORMATION

Ehsan Ghazanfari, Ph.D., P.E.

Associate Professor

Civil & Environmental Engineering Department, University of Vermont

33 Colchester Ave., Burlington, VT, 05405

Phone: (802) 656-1770

Email Address: Ehsan.Ghazanfari@uvm.edu

### A1. EDUCATION

Ph.D.	Lehigh University, Bethlehem, PA (Sept. 2013) Dissertation: Development of a Mathematical Model for Electrically Assisted Oil Transport in Porous Media Advisor: Professor Sibel Pamukcu	2009-2013	Civil Eng. (Geotech.)
M.Sc.	Lehigh University, Bethlehem, PA (Jan. 2013) Advisor: Professor Sibel Pamukcu	2009-2013	Civil Eng. (Geotech.)
M.Sc.	Iran University of Science & Tech. (IUST), (March 2004) Thesis: Parametric Study of Carbonate Sands under Stress Advisor: Professor Hossein Salehzadeh	2001-2004	Civil Eng. (Geotech)
B.Sc.	K.N.Toosi University of Technology, Iran (Sept. 2001)	1997-2001	Civil Eng.

### A2. EMPLOYMENT

Associate Professor	Sept. 2019 – Present	University of Vermont
Assistant Professor	Aug. 2013 – May 2019	University of Vermont
Adjunct Instructor	May 2013 – Aug. 2013	Lehigh University
Research Assistant	Sept. 2009 – May 2013	Lehigh University
Teaching Assistant	Sept. 2010 – May 2013	Lehigh University
Geotechnical Engineer	Sept. 2001- July 2009	Aksco Eng. Inc., Tehran, Iran
Research Assistant	Sept. 2001- Mar. 2004	IUST, Iran

## B. RESEARCH INTERESTS

- Development of shallow and deep geothermal systems
- Geo-mechanical aspects of shale energy and geological carbon sequestration
- Effects of coupled Thermal-Hydrological-Mechanical-Chemical (THMC) process on fracture response
- Sensors and sensing for earthen infrastructures and intelligent compaction of geo-materials
- Behavior of unsaturated soils/rocks under non-isothermal conditions
- Application of electrokinetics in subsurface energy (e.g. electrically enhanced oil recovery)
- Physical and mechanical characterization of extraterrestrial (e.g. Martian, lunar) regolith

<b>C. PUBLICATIONS</b>
------------------------

<b>C1. PEER REVIEWED JOURNAL PAPERS</b>
---

1. Kamali-Asl, A., K-C, B., **Ghazanfari, E.**, & Hedayat, A. (2019). Flow-induced alterations of ultrasonic signatures and fracture aperture under constant state-of-stress in a single-fractured rock. *Journal of Geophysics*, 84(4), 1-58
2. Kamali-Asl, A., K-C., B., Foroutan, M., **Ghazanfari, E.**, Cladouhos, T., Stevens, M. (2019). Stress-Strain Response and Seismic Signature Analysis of Phyllite Reservoir Rocks from Blue Mountain Geothermal Field. *Journal of Geothermics*, 77, 204-223
3. Vahedifard, F., Cao, T.D., **Ghazanfari, E.**, Kumar, Thota, S.K. (2019) "Closed-Form Models for Nonisothermal Effective Stress of Unsaturated Soils." *Journal of Geotechnical and Geoenvironmental Engineering* 145, no. 9 (2019): 04019053.
4. Shahrokhbadi, S., Vahedifard, F., **Ghazanfari, E.**, Foroutan, M. (2019). Earth Pressure Profiles in Unsaturated Soils under Transient Flow. *Journal of Engineering Geology*
5. Mortezaei, K., Amirlatifi, A., **Ghazanfari, E.**, Vahedifard, F. (2018). Potential CO<sub>2</sub> Leakage from Geological Storage Sites: Challenges and Recent Advances. *Journal of Environmental Geotechnics*, (2018): 1-25
6. Kamali-Asl, A., **Ghazanfari, E.**, Newell, P., Stevens, M. (2018). Elastic, Viscoelastic, and Strength Properties of Marcellus Shale Specimens. *Journal of Petroleum Science and Engineering*, 171 (2018) 662-679.
7. Peraki, M., **Ghazanfari, E.**, Pinder, G.F. (2018). Numerical Investigation of Two-phase Immiscible Flow for Oil Production Using a Combination of Waterflooding and Electrically-Enhanced Oil Recovery. *Journal of Petroleum Exploration and Production Technology*, no. 4 (2018): 1505-1518.
8. Kamali-Asl, A., **Ghazanfari, E.**, Hedayat, A., Deering, L. (2018). Investigation of Static/Dynamic Moduli and Plastic Response of Shale Specimens. *International Journal of Rock Mechanics and Mining Sciences*, 110 (2018) 231-245
9. Peraki, M., **Ghazanfari, E.**, Pinder, G.F., (2018). Investigation of the Feasibility of Crude Oil Viscosity Change Under Applied Electrical Field in Porous Media and Its Significance for Transport Phenomena". *Journal of Porous Media*, Vol. 22, Issue 6
10. Andrabi, S.G., **Ghazanfari, E.**, Vahedifard, F., (2018). Relationship Between Brooks-Corey and Fredlund-Xing Soil Water Retention Models. *Journal of Porous Media*, In press
11. Latifi, N., Vahedifard, F., **Ghazanfari, E.**, Rashid, A. S. (2018). Sustainable Usage of Calcium Carbide Residue for Stabilization of Clays. *ASCE Journal of Materials in Civil Engineering*, Vol. 30, Issue 6 30,
12. Vahedifard, F., Cao, T.D., Thota, S.K., **Ghazanfari, E.** (2018). Non-Isothermal Models for Soil Water Characteristic Curve. *ASCE Journal of Geotechnical & Geo-environmental Engineering*, 144(9), 04018061
13. Kamali-Asl, A., **Ghazanfari, E.**, Perdrial, N., Bredice, N. (2018). Experimental Study of Fracture Response in Granite Specimens Subjected to Hydrothermal Conditions Relevant for Enhanced Geothermal Systems. *Geothermics* 72 (2018) 205–224.

14. Latifi, N., Vahedifard, F., **Ghazanfari, E.**, Horpibulsuk, S., Marto, A., Williams, J. (2017). Sustainable Improvement of Clays Using Low-Carbon Nontraditional Additive. *International Journal of Geomechanics*, 18(3), 04017162.
15. Caulk, R., **Ghazanfari, E.**, Perdrial, J., Perdrial, N. (2016). Experimental Investigation of Fracture Aperture and Permeability Change within Enhanced Geothermal Systems. *Geothermics*, Vol. 62, pp 12-21 (2016)
16. Villamor, R., **Ghazanfari, E.**, Asanza, E. (2016). Geomechanical Characterization of Marcellus Shale. *Rock Mechanics and Rock Engineering*, Vol. 49, Issue 9, pp 3403–3424
17. Caulk, R., **Ghazanfari, E.**, McCartnery, J. (2016). Parameterization of a Calibrated Geothermal Energy Pile Model. *Geomechanics for Energy and the Environment*, 5 (2016) 1-15
18. Peraki, M., **Ghazanfari, E.**, Pinder, G.F., Harrington, T.L. (2016). Electrodialysis: Application for the Environmental Protection in Shale-gas Extraction. *Separation and Purification*, Vol. 161, pp 96–103
19. Suleiman, M. T., Ni, L., Raich, A., Helm, J., **Ghazanfari, E.** (2015). Measured Soil-Structure Interaction for Concrete Piles Subjected to Lateral Loading. *Canadian Geotechnical J.*, Vol. 52, pp. 1-12
20. Yoon, S., Cheng, L., **Ghazanfari, E.**, Pamukcu, S., Suleiman, M.T., (2015). A Theoretical and Empirical Analysis of Underground Communication for Wireless Sensor Networks. *Ad Hoc & Sensor Wireless Networks*, Vol. 24 Issue 3, pp 333-348
21. **Ghazanfari, E.**, Pamukcu, S., Pervizpour, M., Karpyn, Z. (2014). Investigation of Relative Permeability Coefficients for Electrically Oil Recovery. *Transport in Porous Media*, Vol. 105, pp. 235-253
22. **Ghazanfari, E.**, Shrestha, R., Miroshnik, A., Pamukcu, S. (2012). Electrically Assisted Liquid Hydrocarbon Transport in Porous Media. *Electrochimica Acta*, 86 (2012) 185-191
23. **Ghazanfari, E.**, Pamukcu, S., Yoon, S., Suleiman, M.T., Cheng, L. (2012). Geotechnical Sensing using Electromagnetic Attenuation in Radio Transceivers. *Smart Materials and Structures*, 21 (2012) 125017
24. Yoon, S., **Ghazanfari, E.**, Cheng, L., Wang, Z., Pamukcu, S., Suleiman M.T., (2012). Subsurface Event Detection and Classification Using Wireless Sensor Networks. *Sensors*, 12(11):14862-14886
25. Muraoka, T., **Ghazanfari, E.**, Shrestha, R., Pamukcu, S. (2011). Electrically Induced Pore Pressures in Clay Slurry. *Separation and Purification*, 79 (2011) 133–138
26. Salehzadeh, H., **Ghazanfari, E.**, (2004). Parametric Study of Carbonate Sands under Triaxial Shearing. *International Journal of Civil Engineering*, Vol.2, No. 4, pp. 223-231

## C2. BOOK CHAPTERS

1. **Ghazanfari, E.**, Pamukcu, S. (2014). Mathematical Modeling of Electrokinetic Transport and Enhanced Oil Recovery in Porous Geo-media. Chapter 5 in *Electrokinetics for Petroleum and Environmental Engineers*, eds. G Chilingar and M Haroun; John Wiley & Sons, Inc., New Jersey, and Scrivener Publishing, LLC, Massachusetts; pp.177-236; 2014; ISBN 978-1-118-84269-0.
2. Pamukcu, S., **Ghazanfari, E.**, Wittle, J.K. (2014). Reduction of Contaminants in Soil and Water by Direct Electric Current. Chapter 2 in *Electrokinetics for Petroleum and Environmental Engineers*, pp.33-102; 2014; ISBN 978-1-118-84269-0.

**C3. PEER REVIEWED CONFERENCE PAPERS**

1. K-C., Bijay, Foroutan, M., **Ghazanfari, E.** (2019). Analysis and Comparison of Estimated Static and Dynamic Moduli of a Dolostone Specimen. Proceedings of ASCE Geo-Congress 2019, Philadelphia, PA, 2019
2. K-C, B., Foroutan, M., Kamali-Asl, A., **Ghazanfari, E.**, Cladouhos, T. (2019). Geomechanical Characterization of a Granodiorite Rock Specimen from Patua Geothermal Field. Proceedings of the 53rd US Rock Mechanics/Geomechanics Symposium, New York, NY, 2019
3. Thota, S.K., Cao, T.D., Vahedifard, **Ghazanfari, E.** (2019). Stability Analysis of Unsaturated Slopes Under Nonisothermal Conditions. Proceedings of ASCE Geo-Congress 2019, Philadelphia, PA, 2019
4. Kamli-Asl, A., **Ghazanfari, E.**, (2018). Response of Marcellus Shale Specimens to Cyclic Loading. Proceedings of International Foundations Congress and Equipment Expo 2018, Orlando, FL, 2018
5. Kamli-Asl, A., **Ghazanfari, E.**, (2017). Investigating the Ductile Response of Marcellus Shale Formation. Proceedings of ASCE Geo-Frontiers 2017, Orlando, FL, 2017
6. Bucci, N., **Ghazanfari, E.**, Lu, H. (2016). Microbially Induced Calcite Precipitation for Sealing Rock Fractures. Proceedings of ASCE Geo-Chicago 2016, Chicago, IL, 2016
7. Villamor Lora, R., **Ghazanfari, E.** (2015). Creep Behavior of Shale Formations in Shale Gas Development. Proceedings of International Foundations Congress and Equipment Expo 2015 (IFCEE 2015), San Antonio, TX, 2015
8. Peraki, M., **Ghazanfari, E.** (2015). Alternative Method of Flow-Back Water Treatment in Shale Gas Development for Environmental Protection. Proceedings of IFCEE 2015, San Antonio, TX, 2015
9. Caulk, R., **Ghazanfari, E.** (2015). Investigation of Construction Specification Effects on Energy Pile Efficiency. Proceedings of IFCEE 2015, San Antonio, TX, 2015
10. Villamor Lora, R., **Ghazanfari, E.** (2014). Geomechanical Characterization of Shale Formations for Sustainable Production. ASCE Shale Energy Engineering Conference, Pittsburgh, PA, 2014
11. Shahrokhabadi, S., Vahedifard, F., **Ghazanfari, E.** (2014). Modeling Flow Regime in Shale using Isogeometric Analysis. ASCE Shale Energy Engineering Conference, Pittsburgh, PA, 2014
12. Peraki, M., **Ghazanfari, E.** (2014). Electrodialysis Treatment of Flow-back Water for Environmental Protection in Shale Gas Development. Proceedings of ASCE Shale Energy Eng. Conference, Pittsburgh, PA, 2014
13. **Ghazanfari, E.**, Pamukcu, S., Karpyn, Z., Vahedifard, F. (2014). Characterization of Oil Bearing Sandstones for Sustainable Oil Production in Electrically Enhanced Oil Recovery. Proceedings of ASCE Geocongress, Atlanta, GA, 2014
14. Pamukcu, S., **Ghazanfari, E.** (2014). Geo-sensing for Developing Sustainable Responses to Environmental Hazards Underground. Keynote Paper, Proceedings of ASCE GeoCongress, Atlanta, GA, 2014
15. **Ghazanfari, E.**, Pervizpour, M., Pamukcu, S., (2012). Mathematical Modeling of Electrically Assisted Hydrocarbon Transport in Porous Media. Proceedings of ASCE GeoCongress, Oakland, CA, 2012
16. **Ghazanfari, E.**, Yoon, S., Pamukcu, S., Suleiman, M.T., Cheng, L., (2012). Real Time Global Subsurface Monitoring using New Application of Wireless Signal Networks, proof of concept. Proceedings of ASCE GeoCongress, Oakland, CA, 2012

17. **Ghazanfari, E.**, Yoon, S., Pamukcu, S., Suleiman, M.T., Cheng, L. (2012). Challenges of Geotechnical Sensing and Monitoring using Underground Wireless Signal Networks. Proceedings of SPIE Smart Structures and systems Conference, San Diego, CA, 2012
18. Shrestha, R., Miroshnik, A., **Ghazanfari, E.**, Pamukcu, S., (2012). Electrically Assisted Recovery of Immiscible Hydrocarbon Liquids from Clayey Formations. Proceedings of ASCE GeoCongress, Oakland, CA, 2012
19. Miroshnik, A., **Ghazanfari, E.**, Shrestha, R., Pamukcu, S., (2012). Electrically Induced Transport of Immiscible Hydrocarbons in Clay Soil. Proceedings of ASCE GeoCongress, Oakland, CA, 2012
20. Yoon S., Cheng L., **Ghazanfari E.**, Wang, Z., Pamukcu S., Suleiman M.T., (2012). Subsurface Monitoring using Low Frequency Wireless Signal Networks. Proceedings of IEEE PerCom Conference, Luzano, Switzerland, 2012
21. **Ghazanfari, E.**, Yoon, S., Dong, Y., Li, X., Medina, C., Seserko, S., Cheng, L., Pamukcu, S., (2011). Subsurface Geo-event Monitoring using Wireless Sensor Networks. Proceedings of ASCE GeoFrontiers Conference, Dallas, TX, 2011
22. Yoon, S., Cheng, L., **Ghazanfari, E.**, Pamukcu, S., and Suleiman, M.T., (2011). A Radio Propagation Model for Wireless Underground Sensor Networks. Proceedings of IEEE Globecom Conference, Houston, TX, 2011
23. Yoon, S., Ghazanfari, E., Cheng, L., Suleiman, M.T., Pamukcu, S., (2011). Subsurface Geo-applications of Wireless Signal Networks. Proceedings of SPIE Smart Structure Conference, San Diego CA, 2011

#### **C4. NON-PEER REVIEWED CONFERENCE PAPERS**

1. K-C, B., Kamali-Asl, A., **Ghazanfari, E.**, Perdrial, N., Cladouhos, T. (2019). "Investigation of fracture permeability evolution in phyllite reservoir rock specimen from Blue Mountain geothermal field". Stanford Geothermal Workshop, February 2019
2. Caulk, R., McCartney, J., **Ghazanfari, E.** (2014). Calibration of a Geothermal Energy Pile Model. COMSOL Conference, Boston, MA, 2014
3. **Ghazanfari, E.**, Pamukcu, S. (2013). Evaluation of Relative Permeability Functions for Oil Bearing Sandstones in Electrically Enhanced Oil Recovery. International Workshop on Geomechanics and Energy, Lausanne, Switzerland, 2013
4. Wittle, K., **Ghazanfari, E.**, Pamukcu, S., (2013). The Use of Direct Current Treatment of Paraffin Plugging in Oil Wells: A case Study. World Congress on Petrochemistry and Chemical Engineering, San Antonio, TX, 2013
5. **Ghazanfari, E.**, Pamukcu, S., (2013). Mathematical Modeling of Hydrocarbon Transport in Porous Media. Seventh M.I.T. Conf. on Computational Fluid and Solid Mechanics, Boston, MA, 2013
6. **Ghazanfari, E.**, Pamukcu, S. (2013). Electrically Induced Hydrocarbon Transport in Oil Bearing Formations. International symposium on electrokinetic remediation, Boston, MA, 2013.
7. **Ghazanfari, E.**, Yoon, S., Cheng, L., Suleiman, M.T., Pamukcu, S., (2011). Wireless Signal Networks for Subsurface Modeling and Geo-Event Characterization. NSF CMMI Engineering Research and Innovation Conference, Atlanta, GA, 2011

#### C5. ABSTRACTS AND POSTERS

1. Kamali-Asl, A., K-C., B., Ghazanfari, E. (2018). Seismic Signatures as a Proxy for Fracture Aperture Alterations in Reservoir Rock. AGU Fall meeting, Washington, DC, December 2018
2. Kamali-Asl, A., **Ghazanfari, E.** (2016). Investigating the Ductile Response of Marcellus Shale Formation. Abstract, Northeast Geotechnical Graduate Research Symposium, UMass Amherst, MA, October 2016
3. Caulk, R., Kamali-Asl, A., **Ghazanfari, E.** (2016). Experimental Investigation of Fracture Aperture and Permeability Change within Enhanced Geothermal Systems. Abstract, Stanford Geothermal Workshop, Stanford, CA, February 2016
4. **Ghazanfari, E.**, Villamor Lora, R. (2016). Ductile Response of Marcellus Shale Formations as a Function of Pressure and Temperature. Abstract, American Rock Mechanics Association Geomechanics Symposium, Houston, TX, June 2016
5. Caulk, R., **Ghazanfari, E.** (2015). Experimental investigation of fracture aperture evolution under coupled thermo-hydro-mechanical-chemical processes encountered in EGS. Abstract, American Geophysical Union Meeting, December 2015
6. Peraki M., Harrington, T., **Ghazanfari, E.** (2014). Electrodialysis Treatment of Flowback Water in Shale Gas Development. Poster, ASCE Shale Energy Eng. Conference, Pittsburgh, PA, July 2014

#### C6. SELECT PRESENTATIONS

- “Geothermal energy: a sustainable energy source”, UVM GUND Institute, February 2018
- “Response of Marcellus Shale Specimens to Cyclic Loading”. International Foundations Congress and Equipment Expo 2018, Orlando, FL, March 2018
- “Geomechanics in shale and deep geothermal energy”. Invited presentation, University of Rhode Island, October 2017
- “Investigating the Ductile Response of Marcellus Shale Formation”. ASCE Geo-Frontiers 2017, Orlando, FL, March 2017
- “Marcellus shale characterization”. Invited presentation, Rensselaer Polytechnique Institute, October 2016
- “State of geo-environmental engineering: challenges and opportunities”. Invited presentation, Third US-Japan Geo-environmental Engineering Workshop, Chicago, IL, August 2016
- “Microbially Induced Calcite Precipitation for Sealing Rock Fractures”. ASCE Geo-Chicago 2016, Chicago, IL, August 2016
- “Exploiting Deep Geothermal Energy”. Governor’s Institute of Vermont Engineering, June 2016
- “Geomechanical Characterization of Marcellus Shale”. Invited presentation, Northwestern University, March 2015
- Geothermal Energy. Governor’s Institute of Vermont Engineering, June 2014
- “Characterization of Oil Bearing Sandstones for Sustainable Oil Production in Electrically Enhanced Oil Recovery”. ASCE Geocongress, Atlanta, GA, February 2014
- “Geothermal: Sustainable Energy Alternative”. Invited presentation, Clarkson University, April 2014
- “Sustainable Geothermal Energy”. UVM Department of Geology, Seminar Series, October 2013
- “New Systems for Energy Development”. Invited presentation, University of New Hampshire, November 2013

- “Mathematical Modeling of Hydrocarbon Transport in Porous Media”. Seventh M.I.T. Conf. on Computational Fluid and Solid Mechanics, Boston, MA, June 2013
- “Electrically Induced Hydrocarbon Transport in Oil Bearing Formations”. International symposium on electrokinetic remediation, Boston, MA, June 2013.
- “Mathematical Modeling of Electrically Assisted Hydrocarbon Transport in Porous Media”. ASCE GeoCongress, Oakland, CA, March 2012
- “Real Time Global Subsurface Monitoring using New Application of Wireless Signal Networks, proof of concept”. ASCE GeoCongress, Oakland, CA, March 2012
- “Challenges of Geotechnical Sensing and Monitoring using Underground Wireless Signal Networks”. SPIE Smart Structures and systems Conference, San Diego, CA, March 2012
- “Subsurface Geo-event Monitoring using Wireless Sensor Networks”. ASCE GeoFrontiers Conference, Dallas, TX, March 2011

## D. RESEARCH GRANTS

### D1. RESEARCH GRANTS AS PI

- 1) Title: Reclaimed stabilized base – stabilizing agent selection & design  
 Agency: Vermont Agency of Transportation  
 Contribution: PI (Co-PI: John Lens, UVM)  
 Amount: \$140,158  
 Award Period: 07/19 – 06/21
- 2) Title: Enhancing intelligent compaction with passive wireless sensors  
 Agency: Department of Transportation, Transportation Infrastructure Durability Center  
 Contribution: PI  
 Amount: \$254,931 (UVM portion: \$115,879)  
 Award Period: 01/18 – 12/19
- 3) Title: Implementation of intelligent compaction for pavement construction in Vermont  
 Agency: Vermont Agency of Transportation  
 Contribution: PI  
 Amount: \$126,554  
 Award Period: 01/18 – 12/19
- 4) Title: Intelligent compaction for embankment, subgrade, and base construction in Vermont  
 Agency: Vermont Agency of Transportation  
 Contribution: PI (Co-PI: Mandar Dewoolkar, UVM)  
 Amount: \$56,829  
 Award Period: 01/15 – 8/16
- 5) Title: Investigation of potential utilization of Martian/Lunar regolith as construction material for building on Mars/Moon (Research Minigrant)  
 Agency: NASA EPSCoR  
 Contribution: PI

- Amount: \$10,000  
Award Period: 06/18 – 12/18
- 6) Title: Exploring innovative approaches to convert Martian/Lunar regolith into construction material (Travel Grant)  
Agency: NASA EPSCoR  
Contribution: PI  
Amount: \$1,800  
Award Period: 04/18 – 12/18
- 7) Title: Application of intelligent compaction for extending the life of transportation infrastructure (Undergraduate Student Fellowship)  
Agency: Transportation Research Center  
Contribution: PI (Given to my undergraduate student Kaitlyn Fuller)  
Amount: \$5,000  
Award Period: 09/18 – 05/18
- 8) Title: Evaluation and adaptation of site investigation techniques for Martian environment (Research Minigrant)  
Agency: NASA EPSCoR  
Contribution: PI  
Amount: \$25,000  
Award Period: 01/17 – 12/17
- 9) Title: Utilization of Martian/Lunar regolith as construction material for building on Mars/Moon in support of NASA in-situ resource utilization initiative (Undergraduate Student Research Assistantship)  
Agency: NASA EPSCoR  
Contribution: PI  
Amount: \$4,620  
Award Period: 05/17 – 8/17
- 10) Title: Application of geophysical techniques for characterization of extraterrestrial regolith (Research Minigrant)  
Agency: NASA EPSCoR  
Contribution: PI  
Amount: \$23,797  
Award Period: 01/16 – 12/16
- 11) Title: Investigation of coupled processes within fractures in enhanced geothermal systems (Graduate Research Assistantship)  
Agency: Vermont Space Grant Consortium  
Contribution: PI  
Amount: \$27,500  
Award Period: 08/14 – 08/15

**D2. OTHER INVOLVEMENTS IN RESEARCH GRANTS**

- 10) Title: Transportation Infrastructure Durability Center  
 Agency: Department of Transportation  
 Contribution: Participating faculty for UVM part  
 UVM PI: Mandar Dewoolkar [Other UVM faculty: Dryver Huston, Ting Tan]  
 Other involved universities: Univ. of Maine (lead), Rhode Island, Connecticut  
 Massachusetts Lowell, and Western New England Univ.  
 Amount: \$1,250,000 (UVM portion); total budget: \$14,200,000  
 Award Period: 09/18 – 09/23
- 11) Title: MRI: Acquisition of a high energy X-ray Microtomography scanner  
 Agency: National Science Foundation  
 Contribution: Participating faculty (PI: Mandar Dewoolkar, UVM)  
 Amount: \$276,793  
 Award Period: 11/14 – 10/15

**E. RESEARCH ADVISING****E1. THESIS ADVISING**

Name	Capacity	Degree	Start Date	Expected Graduation	Research Topic
Bijay K.C.	Advisor	Ph.D.	September 2017	May 2021	Seismic signatures and fracture aperture change in geothermal and shale energy applications
Maziar Foroutan	Advisor	Ph.D.	September 2017	May 2021	Integration of sensing systems with intelligent compaction for improved compaction/monitoring
Arash Kamali-Asl	Advisor	Ph.D.	September 2015	January 2019	Coupled THMC processes in geothermal and shale energy development
Maria Peraki	Advisor	Ph.D.	September 2013	May 2017 (Graduated)	Application of electrokinetics in subsurface energy
Rafael Villamor Lora	Advisor	M.S.	September 2013	May 2015 (Graduated)	Geomechanical characterization of Marcellus shale formation
Robert Caulk	Advisor	M.S.	September 2013	May 2015 (Graduated)	Sustainability of shallow and enhanced geothermal systems

**E2. UNDERGRADUATE RESEARCH SUPERVISION**

Name	Capacity	Major	Period	Research Topic
Gillian Gallagher	Advisor	Civil	Sept. 19 - Present	Reclaimed stabilized base– stabilizing agent selection & design
Kaitlyn Fuller	Advisor	Civil	Sept. 18 - May 18	Sensors and sensing in intelligent compaction

Bonnie McMorrow	Advisor	Environ.	May 17- May 18	Characterization of extraterrestrial regolith
Mathew Stevens	Advisor	Civil	May 17- May 18	3D printing of extraterrestrial regolith
Nicholas Bredice	Advisor	Civil	May 17- Sept. 17	Image analysis for experiments in geothermal systems
Precious Jagun	Advisor	Mechanical	May 16- May 17	Coupled processes in enhanced geothermal systems
Andrea Elhajj	Advisor	Civil	May 15- Sept. 15	Sustainability of enhanced geothermal systems
Nicholas Bucci	Co-Advisor (with Dr. Lu)	Civil	May 15- Dec.15	Application of MICP for subsurface sealing
Erica Quallen	Advisor	Civil	Sept.15- Dec. 15	X-Ray CT image analysis in porous media
Sera Fleishman	Advisor	Environ.	Sept. 14- May 15	Modeling of pile energy using COMSOL
Thalia Harrington	Advisor	Environ.	May 14- May 15	Electrodialysis for flowback water treatment in Marcellus

## F. TEACHING

### F1. COURSES DEVELOPED AND TAUGHT

**CE 180 Geotechnical Principles:** This was a 4-credit (Spring 2014 and 2015 semesters; 3-credit lecture and 1-credit lab) and now is a 3-credit required course for all civil and environmental engineering majors. The course covers basic characteristics of geological materials; soil classifications; physical, mechanical, and hydraulic properties; effective stress principle; seepage, consolidation; stress distribution; settlement analysis; and shear strength of soils. The course included (Spring 2014 and 2015) a laboratory portion with six to eight experiments. Inquiry-based learning and interpersonal/communication skills are introduced through report and discussions on case studies. The students are graded based on homework, case studies, two mid-term examinations and the final examination.

**CE 182 Geotechnical Labs:** This is a 2-credit required course for all civil and environmental engineering majors. The course includes eight to ten experiments designed to reinforce the student's understanding of the covered concepts in CE180 course. Students perform various laboratory tests to determine index, hydraulic, and mechanical and strength properties of soils. In addition, students perform computer modeling of geotechnical systems and compare the results of physical and numerical models. The students are graded based on laboratory and project report writing and presentations.

**CE 285 Geo-energy Systems:** This is a 3-credit course designed for seniors and graduate students. The course counts as a design or professional elective for undergraduate students. The course covers geo-energy technologies for subsurface extraction of energy and secure underground storage of energy byproducts. Different subsurface energy extraction systems including shallow and deep geothermal energy systems, enhanced oil recovery systems, shale gas extraction, and various subsurface systems for storage of carbon dioxide and nuclear wastes are covered in this course. The course has a design project, where students design geothermal energy piles using COMSOL Multiphysics software. In addition, the course has a research project, where students have to conduct literature review on particular topics and present their findings to the class. The students are graded based on homework, summary and discussion on case studies, mid-term and final examinations, and project report and presentation.

**CE 286 Geo-environmental Engineering:** This is a 3-credit course designed for seniors and graduate students. The course counts as a design or professional elective for undergraduate students and offers an introduction to geotechnical aspects of design and construction of waste disposal and containment facilities using geosynthetics, and fundamental aspects of soil-water movement and remediation

technologies. The course has a design project, where students use Slope/W software to design geosynthetic liner systems. In addition, the course has a research project, where students have to conduct literature review on topics related to the course and present their findings to the class. The students are graded based on homework, summary and discussion on case studies, mid-term and final examinations, and project report and presentation.

**CE 395C Advanced Experimental Soil Mechanics:** This is a 3-credit required course for graduate students in geotechnical engineering. The course is designed to help students (i) understand fundamentals of advanced laboratory experiments and in-situ testing to determine soil properties including compressibility, shear strength, permeability, and elastic moduli; and (ii) develop skills in designing and performing advanced experiments and interpreting the obtained data. The students independently learn to perform assigned tests, prepare progress reports, present their findings to the class, and submit a final report and are graded based on progress reports, presentations and final report.

**CE 395B Environmental Geotechnics:** This is a 3-credit graduate course on site characterization, site restoration, and waste disposal and containment (landfills/surface impoundments) from the perspective of modern geotechnical practice. Specific topics include fundamental issues related to waste generation and disposal, design and remediation, risk assessment framework, composition and engineering properties of waste and soils, characterization of the materials used for waste encapsulation, fate and transport of contaminants in groundwater systems, introduction to cutoff walls, liners, covers and caps, and gas and leachate collection-removal systems. The students are graded based on homework, summary and discussion on case studies, mid-term and final examinations, term project and presentation.

## F2. STUDENT EVALUATIONS

Session	Title	Credit	No. of Students Enrolled	Rating / 5.0	CEMS average
Fall 2018	CE 285 Geo-energy Systems (U-G)	3	40	4.58	3.95
Spring 2018	CE 180 Geotechnical Principles (U)	3	65	4.80	3.92
	CE 395B Environmental Geotechnics (G)	3	9	4.78	3.92
	CE 395C Advanced Experimental Soil Mechanics (G); Co-taught with Prof. Dewoolkar	3	4	5.0	3.92
Fall 2017	CE 285 Geo-energy Systems (U-G)	3	43	4.94	3.91
Spring 2017	CE 180 Geotechnical Principles (U)	3	74	4.70	3.95
	CE 285 Geo-energy Systems (U-G)	3	16	4.64	3.95
Fall 2016	CE 286 Geo-environmental Engineering (U-G)	3	26	3.75	3.92
Spring 2016	CE 180 Geotechnical Principles (U)	3	51	3.42	3.86
	CE 182A Geotechnical Labs (U)	1	25	4.53	3.86
	CE 182B Geotechnical Labs (U)	1	24	4.54	3.86
Fall 2015	CE 285 Geo-energy Systems (U-G)	3	24	4.80	4.0
SP 2015	CE 180 Geotechnical Principles (U)	4	71	3.6	3.7
Fall 2014	CE 285 Geo-energy Systems (U-G)	3	22	4.5	3.8
SP 2014	CE 180 Geotechnical Principles (U)	4	49	3.6	3.9
Fall 2013	CE 285 Geo-energy Systems (U-G)	3	13	3.8	3.7

U: undergraduate, U-G: senior-graduate, G: graduate level course, CEMS: College of Engineering and Mathematical Sciences

## G. SERVICE AND PROFESSIONAL DEVELOPMENT

### G1. PROFESSIONAL SERVICE AT NATIONAL LEVEL

#### Conferences

- Session chair (Session ID: GE01: Geo-environmental Engineering; co-organized with Dr. Kristin Sample-Lord) for ASCE Geo-Congress, Philadelphia, PA, March 2019 (Handled 22 manuscripts in the session)
- Session convener (Session ID: MR004+MR005: Coupled processes in geological media and reservoirs: field observations, experimental and modelling); co-organized with Drs. Pania Newell, Georgios Papageorgious, Ismael Falcon-Suarez; session chairs: John Kaszuba, Robert Choens, Jordi Delgado; AGU Fall meeting, Washington, DC, December 2018
- Session chair (Session ID: E06: Rock Mechanics; co-organized with Dr. Ingrid Tomac) for International Foundations Congress and Equipment Expo (IFCEE) 2018 Conference, Orlando, FL, March 18 (Handled 5 manuscripts submitted to the session)
- Session chair (two sessions; co-organized with Dr. Majid Ghayoomi):
  - D50: Laboratory Characterization: Chemical Effects; and
  - D51: Laboratory Characterization: Engineering Properties
 for ASCE Geo-Chicago Conference, Chicago, IL, August 2016 (Handled 15 and 9 manuscripts submitted to sessions D50 and D51, respectively)
- Reviewed the ASCE Geo-environmental standard manual (Spring 18)
- Reviewed conference papers (3) for ASCE GeoCongress 2019, Philadelphia, PA (Summer 18)
- Reviewed conference papers (4) for IFCEE 2018, Orlando, FL (Fall 17)
- Reviewed conference papers (5) for Indian Geotechnical Conf. 2017, IIT Guwahati (Summer 17)
- Reviewed conference papers (3) for IFCEE 2015, San Antonio, TX (Fall 14)
- Reviewed conference papers (2) for ASCE Shale Energy Engineering Conference, Pittsburgh, PA (Summer 13)

#### National Committees

- ASCE Geolnstitute's Committee on Rock Mechanics and Geo-environmental Engineering Committee, 2012 – present
- ASCE Geolnstitute's Geo-environmental Engineering Committee Award Sub-Committee, 2017 – present

#### Journal Reviewer

- ASTM Geotechnical Testing Journal (7)
- Soils and Foundations (2)
- Environmental Geotechnics (2)
- Rock Mechanics and Rock Engineering (1)
- ASME Energy Resources (1)
- ASCE Hazardous Material (2)
- Electrochimica Acta (1)
- Environmental Management (1)
- Ultrasonic (1)
- Techno-Press (1)
- Natural Hazards (1)
- Review of Scientific Instruments (1)
- Acta Geotechnica (1)

#### External Reviewer for Proposals

- ACS Petroleum Funds (Spring 17)

**G2. UNIVERSITY SERVICE**

- Served as University representative on Advisory Committee to the New England Transportation Consortium (Jan. 2018-July 2019)
- Serving on faculty council of the College of Engineering & Mathematical Sciences (CEMS), (Fall 2018-present)
- Served on facilities committee for CEMS (Spring 16, Fall 16, Spring 17)
- Served on subcommittee for ENGR050 course to develop hands-on modules (Spring 18) and assisted in development of the civil engineering module
- Participated in the Catamount Commitment Mentor Program: mentoring first-generation and limited-income students attending UVM, providing them with mentorship and guidance throughout the first year and beyond (Fall 17 and Spring 18)
- Attended College's Admitted Student Visit (ASV) days; met with prospective civil engineering's students at the graduate and undergraduate level, (Spring 15, 16, 17, and 18)
- Attended the Essex STEM academy Design showcase, to help recruit interested students to CEMS, (Summer 17)
- Participated in seminars (geothermal energy) at the Governor's Institutes of Vermont (GIV) that provides hands-on educational opportunities for motivated high school students interested in engineering, in a weeklong workshop, (Summer 14,15, and 16)
- Served as academic advisor for 13 undergraduate students, (Fall 13 - Spring 18)
- Updated the Civil and Environmental Engineering website, (Spring 15, 16, 17)
- Designed, developed, and organized the renovation of "Porous Media" shared research facility and helped design the new undergraduate Geomaterials teaching laboratory (2017, 2018)
- Held FE review sessions for undergraduate students, (Spring 17 and Fall 17)

**G3. THESIS COMMITTEE MEMBER**

Name	Degree	Major	Thesis Title	Date
Adele Conde	M.S.	Geology	Apatite dissolution at the nanoscale	June 2019
Maxwell Landsman-Gerjoi	M.S.	Geology	Incubation vs. fluorescence spectroscopy: a field and lab study on dissolved organic matter bioavailability	May 2019
Griffin Moyer	M.S.	Geology	Understanding structural fabric development and strain partitioning in transpressive shear zones in Fiordland, New Zealand	May 2019
Benjamin Leblanc	Ph.D.	Civil	A fatigue monitoring and prognosis framework for minimally instrumented structural and biomechanical systems	October 2018 (proposal)
Sandra Romero Diez	M.S.	Mechanical	Crystallization study of polymers under high pressure gas / supercritical fluid	June 2018
Laura Obregon	M.S.	Civil	Generating prescribed level of cohesion in soil simulants in support of extraterrestrial terramechanics research	November 2017
Ian Anderson	Ph.D.	Civil	Prediction and mitigation of scour and scour damage to Vermont bridges	October 2017

Justin Bond	M.S.	Mechanical	Status monitoring of inflatables by accurate shape sensing	November 2017
Pegah Jarast-Shamsabadi (UNH)	Ph.D.	Civil	Numerical and physical modeling of cone penetration in unsaturated soil and geo-mechanics of Brazilian test	August 2017
Kate Johnson	Ph.D.	Civil	N/A	April 2017 (proposal)
Evan Tam	M.S.	Geology	Role of the prospect rock fault in the exhumation of high pressure rocks in north-central Vermont	April 2016
Michael Edwards	M.S.	Civil	Characterization of Fillite as a High-sinkage/high-slip planetary soil simulant in support of rover mobility assessment	October 2014

#### **G4. PROFESSIONAL DEVELOPMENT**

- Attended 2<sup>nd</sup> annual NHERI Centrifuge Users' Workshop (CGM) at UC Davis, (May 18)
- Attended Sustainability Faculty Fellows Program, UVM, (Fall 17 and Spring 18)
- Attended Faculty Seminar in Undergraduate STEM Research Mentoring, UVM, (Spring 16)
- Professional Engineer, Geotechnical Eng., State of California, April 2012 (License # C 80324)
- Teacher Development Certificate, Lehigh University, April 2012

#### **G5. PROFESSIONAL AFFILIATION**

- American Society of Civil Engineers (ASCE)
- Geo-Institute of ASCE
- American Rock Mechanics Association
- American Society of Engineering Education
- United States Society on Dams
- United States Universities Council on Geotechnical Education and Research (USUCGER)
- SPIE (The International Society for Optics and Photonics)
- UVM Sustainability Faculty Fellow
- UVM Gund Institute for Environment Faculty Fellow