

Cassandra J. Rutherford, Ph.D.

Civil and Environmental Engineering
University of Illinois, Urbana-Champaign
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Education

2012 Ph.D. Civil Engineering, Texas A&M University (Chair: Giovanna Biscontin)
2004 M.S. Civil Engineering, Texas A&M University
2002 B.S. Civil Engineering, Texas A&M University

Academic Appointments

since 2011 Assistant Professor of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign

Industry Positions

2006–2012 Geotechnical Laboratory Director
TDI-Brooks International, Inc., College Station, Texas

Professional Certifications

since 2001 Engineer-in-Training (EIT), State of Texas No. ET-32841

Fellowships, Honors, and Awards

2015 NSF Faculty Early Career Development (CAREER) Award
2015 University of Illinois at Urbana-Champaign List of Teachers Ranked as Excellent
2012 ASCE Excellence in Civil Engineering Education (ExCEED) Fellow
2006 SRW Cassie Rutherford Volunteer Organization Award (Namesake)
2005 Association of Former Students Buck Weirus '42 Award
2005 Montgomery Endowed Fellowship Prize

Research Funding

TOTAL AWARDED: \$1,332,690

2015–2020 *CAREER: Experimental Modeling of Tidal Current Turbine Foundations: An Integrated Research and*
(awarded) *Education Plan*
Source: National Science Foundation; Total Awarded: \$500,000
Role: Principal Investigator

2012–2016 *Investigation and Modeling of Element-Level Soil Behavior Under Multi-Dimensional Loading*
(awarded) Source: Nuclear Regulatory Commission; Total Awarded: \$786,500
Role: co-Principal Investigator; PI: Scott Olson (Illinois), co-PI: Youssef Hashash (Illinois)

2012–2013 *Hydrodynamic Behavior of Thickened Tailings*
(awarded) Source: Exxon-Mobil Corporation; Total Awarded: \$46,130
Role: co-Principal Investigator; PI: Marcelo Garcia (Illinois)

Educational Funding

TOTAL AWARDED: \$168,363

2015–2016 *Research Experience for Undergraduates*
(awarded) Source: National Science Foundation; Total Awarded: \$10,000
Role: Principal Investigator

2014–2015 *CEE Women Exploring Graduate Opportunities in Civil and Environmental Engineering Workshop*
(awarded) (WeGoCEE)
Source: Civil & Environmental Engineering; Total Awarded: \$30,000
Role: Principal Investigator

2014–2015 *Geotechnical Laboratory Instructional Innovation Grant*
(awarded) Source: College of Engineering; Total Awarded: \$78,363
Role: Principal Investigator

2014–2015 *Extending the Curriculum Content of an Existing Sketch Recognition Tutoring System with Immediate Feedback to Engage Cross-Disciplinary Instructors*
(awarded) Source: College of Engineering; Total Awarded: \$63,973
Role: co-Principal Investigator; PI: Joshua Peschel (Illinois), co-PI: Megan Konar (Illinois)

2013–2014 *A Flow Net Sketch Recognition Tutoring System: Improved Student Learning through Mobile Active Learning and Immediate Student Feedback*
(awarded) Source: College of Engineering; Total funding: \$50,000
Role: co-Principal Investigator; PI: Joshua Peschel (Illinois), co-PI: Megan Konar (Illinois)

Peer-Reviewed Journal Publications

(PUBLICATIONS WITH ADVISED STUDENTS* AS NOTED)

12. Vashish Taukoor*, Jeff F. Wallace*, **Cassandra J. Rutherford**, Bernie B. Bernard, Mathew S. Hodder, and David J. White. (2015) “Modeling the Undrained Shear Strength Degradation of Gulf of Mexico Clays Using the Cyclic T-Bar Penetration Test”. *Geotechnique*, in preparation.
11. **Cassandra J. Rutherford**, Giovanna Biscontin, and Madhuri Murali. (2015) “Slope Stability Analyses Along the Sigsbee Escarpment in the Gulf of Mexico”. *Marine Geology*, in preparation.
10. Lopamurda Bhaumik, **Cassandra J. Rutherford**, Scott Olson, and Youssef Hashash. (2015) “Strain-Controlled Multi-Directional Simple Shear Testing of Dense Sands”. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, in preparation.

9. Jim Long, Pouyan Asem*, and **Cassandra J. Rutherford**. (2015) "Estimation of Weak Rock Mechanical Properties for Drilled Shaft Foundation Design". *Journal of Rock Mechanics and Geotechnical Engineering*, in preparation.
8. **Cassandra J. Rutherford** and Giovanna Biscontin. (2015) "Multi-Directional Simple Shear Response of Gulf of Mexico Clays". *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, in preparation.
7. Vashish Taukoor* and **Cassandra J. Rutherford**. (2015) "Strain Rate Effects During T-Bar Cycling in Gulf of Mexico Clay". *Geotechnique*, in submission.
6. Jeff F. Wallace* and **Cassandra J. Rutherford**. (2015) "Response of Vertical Cyclic Loading of Suction Caissons in Soft Clays". *Canadian Geotechnical Journal*, in submission.
5. Jeff F. Wallace* and **Cassandra J. Rutherford**. (2015) "Comparison of Model Testing, Limit Equilibrium, and Finite Element Analysis of Monotonically Loaded Suction Caissons in Soft Clay". *Canadian Geotechnical Journal*, in submission.
4. Jeff F. Wallace and **Cassandra J. Rutherford**. (2015) "Geotechnical Properties of Laponite RD". *ASTM Geotechnical Testing Journal*. 38(5). doi:10.1520/GTJ20140211.
3. Christopher M. Chini*, Jeff F. Wallace, **Cassandra J. Rutherford**, and Joshua M. Peschel. (2015) "Shearing Failure Visualization via Particle Tracking in Soft Clay using a Transparent Soil". *ASTM Geotechnical Testing Journal*. 38(5). doi:10.1520/GTJ20140210.
2. **Cassandra J. Rutherford** and Giovanna Biscontin. (2013) "Development of a Multi-Directional Simple Shear Testing Device". *ASTM Geotechnical Testing Journal*. 36(6), 1–10. doi:10.1520/GTJ20120173.
1. **Cassandra J. Rutherford**, Giovanna Biscontin, Demetrios Koutsoftas, and Jean-Louis Briad. (2007) "Design Process of Deep Soil Mixed Walls for Excavation Support". *International Journal of Geoenvironment Case Histories*. 1(2), 56–72. .

Other Publications

PEER-REVIEWED CONFERENCE PROCEEDINGS
(PUBLICATIONS WITH ADVISED STUDENTS* AS NOTED)

12. Jim Long, Pouyan Asem*, and **Cassandra J. Rutherford**. (2016) "In-Situ Modulus of Deformation of Weak Rock Masses for Drilled Shaft Design". In *Proceedings of the 50th US Rock Mechanics/Geomechanics Symposium*, American Rock Mechanics Association, June 26–29, 2016, Houston, TX, USA (in review).
11. Jeff F. Wallace* and **Cassandra J. Rutherford**. (2016) "Suction Caissons in Soft Clay for Tidal Current Turbine Applications". In *Proceedings of Geo-Chicago 2016*, American Society of Civil Engineers, August 16–28, 2016, Chicago, IL, USA (in revision).
10. Scott Olson, Youssef Hashash, **Cassandra J. Rutherford**, Alfonso Cerna-Diaz*, Ozgun Numanoglu*, and Lopamurda Bhaumik. (2015) "Cyclic Response of Dense Sands in Dynamic Centrifuge Tests with 1D and 2D Shaking". In *Proceedings of the 6th International Conference on Earthquake Geotechnical Engineering*, November 2–5, 2015, Christchurch, New Zealand.

9. Jeff F. Wallace* and **Cassandra J. Rutherford**. (2016) "Visualizing the Failure Surface of a Laboratory Vane Shear in Soft Clay Using Transparent Soil". In *Proceedings of the 3rd International Symposium on Frontiers in Offshore Geotechnics*, June 10–12, 2015, Oslo, Norway.
8. Jeff F. Wallace*, Christopher M. Chini*, Joshua M. Peschel, and **Cassandra J. Rutherford**. (2015) "Failure Mechanism of a T-Bar Penetrometer Visualized in Soft Clay Using Transparent Soil". In *Proceedings of the 2015 International Foundations Congress and Equipment Exposition*, March 17–21, 2015, San Antonio, TX, USA.
7. Chris L. Bukhair, Tonya Thomas, **Cassandra J. Rutherford**, and Giovanna Biscontin. (2009) "Slope Stability for Submarine Clays: Triaxial and Consolidation Testing". In *Proceedings of the 4th International Symposium on Submarine Mass Movements and Their Consequences*, November 7–12, 2009, Austin, TX, USA.
6. **Cassandra J. Rutherford** and Giovanna Biscontin. (2009) "Multi-Directional Simple Shear Response of Gulf of Mexico Clays". In *Proceedings of the 4th International Symposium on Submarine Mass Movements and Their Consequences*, November 7–12, 2009, Austin, TX, USA.
5. **Cassandra J. Rutherford** and Giovanna Biscontin. (2008) "Multi-Directional Simple Shear Testing of Fine-Grained Marine Sediments". In *Proceedings of the 33rd International Geological Congress*, August 6–14, 2008, Oslo, Norway.
4. Han E. Low, Mark F. Randolph, **Cassandra J. Rutherford**, Bernie B. Bernard, and Jim M. Brooks. (2008) "Characterization of Near Seabed Surface Sediment". In *Proceedings of the Offshore Technology Conference*, May 5–8, 2008, Houston, TX, USA.
3. **Cassandra J. Rutherford**, Giovanna Biscontin, Dimetrious Koutsoftas, and Jean-Louis Briaud. (2006) "Numerical Modeling of Deep Soil Mixing Excavation Support". In *Proceedings of the 2006 Geo-Frontiers*, January 24–26, Austin, TX, USA.
2. **Cassandra J. Rutherford**, Giovanna Biscontin, and Jean-Louis Briaud. (2005) "Deformation Predictions Based on Estimates of Soil Cement Modulus and Flexural Stiffness". In *Proceedings of the 11th International Conference of International Association for Computer Methods and Advances in Geomechanics (IACMAG)*, June 19–24, 2006, Turin, Italy.
1. **Cassandra J. Rutherford**, Giovanna Biscontin, and Jean-Louis Briaud. (2004) "Deep Mixing for Excavation Support: Design Issues". In *Proceedings of the GeoTrans 2004*, July 27–31, 2004, Los Angeles, CA, USA.

CONFERENCE PRESENTATIONS AND POSTERS
(PUBLICATIONS WITH ADVISED STUDENTS* AS NOTED)

3. Ozgun A. Numanoglu*, Youssef M. A. Hashash, Alfonso Cerna-Diaz*, Scott M. Olson, Lopamudra Bhaumik*, **Cassandra J. Rutherford**, and Thomas Weaver. (2016) "Seismic Performance Evaluation of Nonlinear Soil-Structure System Under Multidirectional Shaking". Geotechnical and Structural Engineering Congress (Geo-Structures 2016), February 14–17, 2016, Phoenix, AZ, USA (accepted for oral presentation).
2. Jeff F. Wallace* and **Cassandra J. Rutherford**. (2016) "Response of Suction Caissons in Clay Subjected to Monotonic and Cyclic Vertical Loading". Geotechnical and Structural Engineering Congress

(Geo-Structures 2016), February 14–17, 2016, Phoenix, AZ, USA (accepted for oral presentation).

1. **Cassandra J. Rutherford** and Giovanna Biscontin. (2010) “The Effect of Shearing Rate and Slope Angle on the Simple Shear Response of Marine Clays”, AGU Fall Meeting, December 13–17, 2010, San Francisco, CA, USA.

Invited Talks

11. “Offshore Geotechnical Engineering.” Invited Speaker, Summer Scholar’s Seminar, University of Illinois at Urbana-Champaign, College of Engineering, December 9, 2015.
10. “Offshore Foundation Design for Renewable Energy.” Invited Geotechnical Seminar Speaker, Kansas State University, Manhattan, KS, USA, October 1, 2015.
9. “Offshore Geotechnical Engineering.” Invited Speaker, Summer Scholar’s Seminar, University of Illinois at Urbana-Champaign, College of Engineering, July 1, 2014.
8. “Undrained Shear Strength of Submarine Slopes.” Invited Workshop Speaker, The 12th G.A. Leonards Lecture, Purdue University, West Lafayette, IN, USA, April 26, 2014.
7. “Women in Engineering Academics.” Speaker, GradSWE (Graduate Society of Women Engineers), University of Illinois at Urbana-Champaign, Invited Guest and Speaker, Nov. 4, 2013.
6. “Women Empowered in Science, Technology, Engineering and Mathematics.” Speaker, WeSTEM Conference, University of Illinois at Urbana-Champaign, April 20, 2013.
5. “Undrained Shear Strength of Submarine Slopes.” Invited Seminar Speaker, Illinois State Geological Survey, Urbana, IL, USA, April 1, 2013.
4. “Offshore Geotechnical Engineering.” Invited Speaker, Civil and Environmental Engineering Alumni Dinner, Chicago, IL, USA, March 14, 2012.
3. “Development of a Multi-Directional Simple Shear Testing Device.” Invited Structures Seminar Speaker, Civil and Environmental Engineering, University of Illinois, Urbana, IL, USA, September 10, 2012.
2. “Development of a Multi-Directional Simple Shear Testing Device.” Invited Departmental Seminar Speaker, Civil and Environmental Engineering, University of Illinois, Urbana, IL, USA, May 5, 2011.
1. “Development of a Multi-Directional Simple Shear Testing Device.” Invited Departmental Seminar Speaker, Civil Engineering, University of Nebraska, Lincoln, NE, USA, March 7, 2011.

Instruction

CURRENT PH.D. STUDENTS

Ms. Lopamudra Bhaumik; anticipated graduation: May 2016

Dissertation Title: “Investigation of Element-Level Behavior of Dense Sand Under Multidirectional Cyclic Simple Shear Loading Conditions”

Mr. Jeff Wallace; anticipated graduation: May 2016
Dissertation Title: "Response of Suction Caissons Under Cyclic Loading for Tidal Current Foundation Applications"

Mr. Vashish Taukoor; anticipated graduation: May 2017
Dissertation Title: "Undrained Shear Strength Degradation of Soft Clays Under Cyclic Loading"

Mr. Alfonso Cerna Diaz (co-advised with S. Olson); anticipated graduation: May 2017
Dissertation Title: "Evaluation of Cyclic Behavior of Dense Sand Under Multidirectional Loading Using Centrifuge Tests"

Mr. Ozgun Numanoglu (co-advised with Y. Hashash); anticipated graduation: May 2017
Dissertation Title: "Modeling of Dense Sand Behavior Under Multi-Dimensional Loading"

Mr. Pouyan Asem (co-advised with J. Long); anticipated graduation: May 2017
Dissertation Title: "Design of Drilled Shafts in Weak Rocks"

Mr. Joseph Gamez (co-advised with S. Olson); anticipated graduation: May 2018
Dissertation Title TBD

CURRENT M.S. THESIS STUDENTS

Mr. Adrian Naranjo; anticipated graduation: December 2015
Thesis Title: "Experimental Set-Up of Resonant Column/Torsional Shear Device"

Mr. Daniel Hauser; anticipated graduation: May 2016
Thesis Title: "Effects of Plasticity of Fines in Resonant Column/Torsional Shear"

GRADUATED M.S. THESIS STUDENTS

Mr. Christopher M. Chini (co-advised with J. Peschel); graduated May 2015
Special Academic Honors: SRIS Fellow; CEE Distinguished Fellow; NSF Graduate Fellow
Thesis Title: "An Experimental Method for Visualizing Undrained Shearing Failure in a Transparent Soft Clay Surrogate"
First Position: Ph.D. Student; CEE SRIS Program, University of Illinois at Urbana-Champaign

UNDERGRADUATE STUDENTS SUPERVISED

Ms. Sarah Menz (CEE REU); Fall 2015
Project Title: Geotechnical Characterization of Kaolin for use in Model Scale Testbeds

Mr. A.J. Unander (CEE REU); Fall 2015
Report Title: PLAXIS Modeling for Underwater Foundations in Clay

Mr. Daniel Chang (CEE REU); Fall 2015
Report Title: Characterization of Sand Under Cyclic Loading

Mr. Krish Saxena (CEE Undergraduate Research Assistant); August 2015 – present
Project Title: 3D Printing of Modified Split Model of Triaxial Testing

Mr. Antonio Domel (CEE 497 Independent Study); Spring/Fall 2015
Project Title: Small Scale Testing of Tidal Current Turbines

PREVIOUS UNDERGRADUATE STUDENTS SUPERVISED

Mr. Daniel Hauser (CEE REU); Spring 2014

Report Title: Characterization of Kaolinite Testbeds for 1G Scale Model Testing

First Position: CEE MS Program with C.J. Rutherford, University of Illinois at Urbana-Champaign

Mr. Gordon Stone (CEE REU); Fall 2014

Report Title: Characterization of Laponite Samples for *In Situ* Testing First Position: CE MS Program with N. Stark, Virginia Tech

Ms. Catherine Alice (CEE REU); Summer 2014

Report Title: Geotechnical and Optical Properties of Laponite and Layered Laponite-Soil First Position: CE MS Program in Structural Engineering, University of Illinois at Urbana-Champaign

TEACHING

Fall 2012; Instructor, *CEE 380 Introduction to Geotechnical Engineering*
 Spring 2013; Lecture-discussion course for upper-level undergraduates on the classification of soils, compaction
 Spring 2014; in the laboratory and in the field, soil exploration, boring and sampling, permeability of soils, one-
 Spring 2015 dimensional settlement analyses, strength of soil, and foundations.

Fall 2014; Instructor, *CEE 585 Deep Foundations*

Fall 2015 Lecture-discussion course for advanced graduate students on the ultimate capacities and load-deflection of piles and drilled shafts subjected to compressive loads, tensile loads, and lateral loads; effects of duration of load, soil-structure interaction; two- and three-dimensional analysis of pile groups with closely-spaced piles; effects of installation; inspection of deep foundations and full-scale field tests.

OUTREACH

since 2014 STEM Outreach, Booker T. Washington Elementary, 2 week Geotechnical Engineering lesson plan on renewable energy for 4th grade.
 since 2014 Girls' Adventures in Mathematics, Engineering, and Science (GAMES) Camp: Environmental Engineering and Sustainability Track, Tidal Current Turbine experiments.
 since 2013 STEM Outreach, Booker T. Washington Elementary, 2 week Geotechnical Engineering lesson plan and design project for 2nd grade.

Service to the Profession

UNIVERSITY OF ILLINOIS CAMPUS SERVICE

2015 Member, CEE Energy Water Environment System (EWES)
 2015 Faculty committee, CEE major gift officer search
 2014 Chair and Organizer, Women Exploring Graduate Opportunities in CEE (WE GO CEE), Women's Graduate Recruiting Event
 2012-2013 ENG 198-Grand Challenges, College of Engineering, "Restore and Improve Urban Infrastructure"
 since 2013 Member, CEE Societal Risk Management (SRM)
 since 2012 Member, CEE Graduate Affairs Committee (GAC)-Geotechnical Engineering Group (GEG) representative
 since 2012 Coordinator, Exploring Your Options Summer Camp, College of Engineering, Geotechnical Engineering Mechanically Stabilized Earth Wall Activity
 since 2011 Member, CEE Graduate Recruitment Weekend Planning Committee

MEMBERSHIP IN PROFESSIONAL AND HONORARY SOCIETIES

since 2015	American Society of Civil Engineers Member, Marine Renewable Energy Technical Committee
since 2014	American Society of Testing and Materials, ASTM Member, D18 Soil and Rock Technical Committee
since 2014	American Society of Testing and Materials, ASTM Member, D18.09 Cyclic and Dynamic Properties of Soils Technical Committee
since 2014	American Society of Civil Engineers; Geo-Institute Member, Soil Properties and Modeling Technical Committee
since 2013	International Society of Soil Mechanics and Geotechnical Engineering Member, Students and Younger Members Presidential Group (SYMPG)
since 2013	Deep Foundations Institute Member, Women of DFI Committee
since 2013	Deep Foundations Institute Member, Marine Foundations Technical Committee
since 2011	International Society of Soil Mechanics and Geotechnical Engineering Member, Offshore Geotechnics Technical Committee
since 2011	United States Universities Council on Geotechnical Education and Research
since 2011	Geo-Institute
since 2002	American Society of Civil Engineers
since 2002	American Society of Engineering Education
2001	National Honor Society Chi Epsilon

CONSULTING ACTIVITIES

2007	Geoscience Earth and Marine Services, Inc. (GEMS), Houston, TX
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Professional Development

TEACHING DEVELOPMENT

2015	Pile Driving Contractors Association (PDCA) 8th biennial Professor's Driven Pile Institute (PDPI) June 22 - 26, 2015, Utah State University.
2013	Flipped Classroom Workshop, University of Illinois at Urbana-Champaign, July 11, 2013.
2013	Course Redesign Workshop, University of Illinois at Urbana-Champaign, July 10, 2013.
2012	Fast Start Faculty Development Program, Academy for Excellence in Engineering Education, College of Engineering, University of Illinois at Urbana-Champaign.
2012	Impact of Broadening Participation on Engineers of the Future, Omnia El-Hakim, NSF Program Director of Diversity and Outreach, April 18, 2012.
2012	University Professors' Program on Sheet Pile Retaining Wall System - Arcelor Mittal/Skyline Steel and Nucor-Yamato Steel, San Francisco CA, March 22-23, 2012.
2012	Creating a Teaching Philosophy State that Describes and Documents Your Teaching - University of Illinois - Center for Teaching Excellence March 12, 2012.
2012	Using Students' Prior Knowledge to Help Learning - University of Illinois - Center for Teaching Excellence March 1, 2012.
2012	The Deliberate Mentor: Performing the Role(s) with Thought and Purpose, University of Illinois, Graduate College January 10, 2012.

ACADEMIC DEVELOPMENT

- 2014 International Workshop on Education of Future Geotechnical Engineers in Response to Emerging Multi-scale Soil-Environment Problems, University of Cambridge, September 5-6, 2014.
- 2013 Purdue Conference for Pre-Tenure Women, September 26-27, 2013.
- 2013 Moving Forward: Advancing the Future of Women Faculty at Illinois, University of Illinois at Urbana-Champaign, February 28, 2013.
- 2013 NSF CAREER Proposal Writing Workshop April 8 – 9, 2013, Tampa, FL.
- 2013 Big 10 Women’s Workshop for Mentoring and Networking, University of Michigan, Milwaukee, WI, April 3-5, 2013.
- 2012 Writing/Designing NSF Proposal Workshop, Grant Training Center, University of Illinois at Chicago, November 29, 2012.
- since 2012 Faculty mentoring program, Campus Programs on Teaching and Learning, University of Illinois at Urbana-Champaign.
- 2012 Career Development Workshop - Academy for Excellence in Engineering Education - March 16, 2012.
- 2012 Achieving Tenure and Promotion Workshop - UIUC Chapter American Association of University Professors - March 13, 2012.
- 2012 Deep Foundation Institute - Atlas Tube Plant Tour March 6, 2012.
- 2011 Introduction to Marine Site Characterization - The Society for Underwater Technology Houston Branch, Offshore Site Investigation and Geotechnics Committee, Houston Texas, December 8-9, 2011.

Cassandra J. Rutherford - Research Statement

My research interests are hazard mitigation, the characterization of soil subjected to dynamic loading and the design of offshore foundations for renewable energy applications. I am also interested in the advancement of laboratory testing devices, centrifuge modeling, offshore in situ testing and investigation of offshore geohazards.

Harvesting renewable energy sources such as wind, wave and tidal currents have received great interest from researchers, the energy industry and government agencies around the world. Effective and economical foundations are a critical need for the installation of offshore power generation systems. My research interests are to investigate efficient and reliable foundation systems for a new generation of offshore renewable energy devices, particularly with respect to: (i) foundation stability and dynamic response for installations in differing geologic conditions; and (ii) developing new foundation design methodologies to account for the effects of cyclic loading from wave, storm and tidal action.

I was recently awarded the National Science Foundation CAREER Award (CMMI-1454413) “Experimental Modeling of Tidal Current Turbine Foundations: An Integrated Research and Education Plan.” The research objective of this work is to evaluate *suction caisson foundation systems for tidal current turbines* by examining the foundation performance using both 1g bench-scale (conducted in transparent soil and Kaolin) and centrifuge testing under horizontal and vertical cyclic loading. The research focuses on the cyclic nature of the vertical, horizontal and moment loading due to waves, the rotation of the tidal current turbine blades and the change in direction of the horizontal loading due to ebb and flow tides. Decreasing the cost of the foundation system can be an important part of making tidal power a viable source of energy. However, it will require a better understanding of the soil-foundation system response to the possible loading combinations and tools to model the influence of the soil and foundation on the whole system.

My research also involves *hazard mitigation* and the *characterization of soils under dynamic loading*. A current project funded by the Nuclear Regulatory Commission (NRC-HQ-12-C-04-0117) investigates the stress-shear strain-volumetric strain behavior of dense sands under seismic loading. The collaborative research involves centrifuge testing (Prof. Scott Olson), numerical modeling (Prof. Youssef Hashash) and advanced laboratory testing (Prof. Cassandra Rutherford). The experimental plan involves the use of a newly constructed multi-directional simple shear device based on work from my doctoral research at Texas A&M University (Rutherford 2012; Rutherford and Biscontin, 2008, 2009, 2010, 2013). The new multi-directional simple shear device allows loading along three independent axes, two perpendicular horizontal directions to allow any stress or strain paths in the horizontal plane, and a third in the vertical direction. Solving many of the limitations of previous types of multi-directional simple shear devices, this prototype provides the ability to apply shear stresses and complex loading paths to soil samples. This work encompasses the design, machining, and construction of the main testing device as well as the support systems. State-of-the-art control, loading, and data acquisition systems were developed to allow testing in a large range of frequencies and stress paths. My doctoral research investigated the response of marine soils to dynamic loads such as earthquake and wave action which may cause submarine landslides. The experimental program focused on investigating the effects of anisotropy and shearing rate of Gulf of Mexico clay subjected to cyclic loading. The construction of pipelines, anchoring systems, wind turbines, and current power generators require offshore site investigations and the characterization and response of the soil to dynamic loading. I am interested in the behavior of soil subjected to complex loading patterns caused by repeated wind and wave forces, earthquakes, and storm loading for the modeling and design of subsea structures and infrastructure.

Through my industry experience with TDI-Brooks International and Geoscience Earth & Marine Services, Inc., I have participated in offshore geotechnical sampling cruises and have managed the offshore and onshore laboratory testing for site investigation programs. I collected all of the Gulf of Mexico (GOM) samples for the experimental program of my dissertation and have 200 meters of donated GOM samples in my lab. I have also worked in the development and testing of a t-bar penetrometer and the TDI-Brooks Intl. Cone Penetrometer (CPT) Stinger. My students used transparent soils and digital image correlation to investigate failure mechanisms around t-bar and cone penetrometers (Wallace and Rutherford, 2014; Chini et al. 2014; Wallace et al. 2015).

The successful development of offshore structures and subsea foundations lies at the intersection of geologic oceanography, foundation engineering, structural engineering, naval architecture, and geotechnical engineering. My expertise in offshore sampling, advanced soil testing, and development of prototype testing devices allows me to collaborate across fields and continue to make strides in the exploration for energy sources and assessment and mitigation of geohazards. I am very enthusiastic about pursuing these goals in an academic setting where opportunities for collaborations across diverse fields are abundant and where innovative thinking is encouraged.

Cassandra J. Rutherford - Teaching Philosophy

My goals as an educator focus on three areas: (1) motivate students to study geotechnical engineering through my enthusiasm and excitement, (2) teach strong fundamentals by using examples, applications, and case studies to allow students to relate theory, geotechnical engineering projects, and state-of-the-art research problems, and (3) develop communication, critical thinking, and problem solving skills. I have pursued opportunities to develop teaching skills and study educational pedagogies through the Center for Teaching Excellence at the University of Illinois at Urbana-Champaign and through the ASCE Excellence in Civil Engineering Education (ExCEED) program. I currently teach the undergraduate course Introduction to Geotechnical Engineering to over 120 junior and senior level students and the graduate course Deep Foundations for 30 graduate students.

I have developed course notes, in-class demonstrations, group activities, homework assignments, and examinations for the classes. I believe that keeping expectations and course requirements transparent is essential to teaching. For each lecture, I provide detailed learning objectives to the students. I use these objectives when writing homework, quizzes and exams to assess the students learning. I also assess teaching methods and student understanding regularly by asking students to identify the most important topic covered and any concepts that are still confusing. I provide weekly homework sessions in which students can ask questions about problems they are currently working.

Motivation

I believe that one of the most important aspects of learning is the excitement of discovering something new. When students are convinced what they are learning is important and useful, they are more engaged in the subject. One way in which I help students see the importance of geotechnical engineering is by providing the “big picture.” I illustrate how each type of Civil Engineering project starts as a geotechnical engineering problem. I strive to make the classroom an interactive environment in which students feel comfortable asking questions. I also make an effort to learn every student’s name and to encourage their active participation during class. At the beginning of the semester, I have the students complete a student information sheet and include a headshot. I review the student information sheets before each class to learn students’ faces and names.

Fundamentals

Traditionally, geotechnical engineering courses are taught in a lecture style in which definitions, basic concepts, and analytical problem solving methods are provided to the students though derivations and step-by-step procedures on the board. Often students do not understand how these equations and well-defined steps relate to geotechnical engineering projects. I find that students have a better understanding of the topics being presented in class if they can make a connection with what they already know. I also have a group activity at the beginning of each class that draws upon their current knowledge and the reading assignment for the lecture. I ask the students to work in groups of three or four to answer the posed questions. I find that a group activity at the beginning of class encourages interaction throughout the lecture. I believe that worked out examples are very useful for explaining the steps to solving the problems; however, the best learning occurs when students work out problems together and teach one another. I have found that it is beneficial for student to teach their peers because it allows them to see the material from different perspectives. When working an example on the board, I ask the students to work in groups on the next step and compute the required solution. Also, because class time is limited, I prepare examples as handouts so that students can study the problems at their own pace.

Skill Development

Because every engineering project is never the same project in the same soil, students need to gain problem-solving skills. Engineering judgments as well as a strong understanding of the basic principles of soil mechanics and design is required. I encourage critical thinking and problem solving with assignments and working case histories. I find that team projects allow students to work together to determine the best approach for solving open-ended design problems. I believe that writing and communication are some of the most important skills students need to develop. I assign written reports as apart of the team projects allowing students to gain experience with communicating their ideas to others. Geotechnical engineering is a diverse field with topics ranging from soil physics and mechanics to dynamics and foundations. My goals as an instructor are to encourage students to see the how geotechnical engineers fit into the “big picture,” to be confident in their strong fundamentals, and to use critical thinking skills to solve the next challenges in our field.