Graduate Studies in Engineering and Computer Science at the University of Central Florida

Department of Civil, Environmental and Construction Engineering



Civil, Environmental and Construction Engineering (CECE)

Faculty and Students	Faculty	Lecturers	Doctoral Students	Master Students
Number	26	3	95	84

Research Areas:

- Smart Cities
- Water resources and quality
- Structural health monitoring
- Infrastructure
- Transportation
- Traffic safety
- Environmental engineering
- Sinkholes and other geotechnical topics

Facts of Interest:

- \$6.175 mil research expenditure in 2016/2017
- 900 undergraduates
- 167 graduate students
- 106 journal articles in 2016/17
- World's largest rainfall simulator; sinkhole simulator
- Modeling capabilities in Water Resource's, Structures
- Structures and water processes analytical/experimental labs





• Internet of things, Virtual, augmented and mixed Reality, Cyber security

UNIVERSITY OF CENTRAL FLORIDA

UCF

and Computer Science

Department of Civil, Environmental and Construction Engineering (CECE)

Big Data Applications, Safety, Simulation, Traffic Management

Dr. Mohamed Abdel-Aty, PE

□ITS Traffic Detection System

- Strength of ITS
 - High Deployment Density
 - Real-time Monitoring

➢ Congestion

- Time duration
- Congestion area
- Congestion intensity
- ➤ Safety
 - Crash precursors
 - Crash's effects





Department of Civil, Environmental and Construction Engineering (CECE)

Traffic Operations and Safety

Professor Essam Radwan

Directional Diamond Interchange

Proposed new design to enhance capacity and level of service



Using Micro-simulation for Pedestrian Safety Surrogate Measures





Transportation Modeling



Montreal Bikeshare

- Research Areas
 - Transportation Planning
 - Freight modeling
 - Connected vehicle technologies, Driverless technologies
 - Public transit ridership and bicycle sharing systems
 - Transportation Health and Equity
 - Quantifying the influence of traffic pollution on public health and equity issues

- Studying behavior employing advanced mathematics
 - Formulate new econometric models
 - New estimation approaches
 - Agent based micro-simulation platforms

Spatial Distribution of Florida Bicycle-Motor Vehicle Crash Frequency





- Research Areas
 - Transportation Safety
 - Traffic crash analysis of driver injury
 - Pedestrian and bicyclist injury
 - Statistics
 - Data mining, Data pooling, and Big data analytics

College of Engineering ucf and Computer Science http://www.people.cecs.ucf.edu/neluru/index.html **Department of Civil, Environmental and Construction Engineering (CECE) Traffic Operations and Safety**

- Haitham Al-Deek, PhD, PE
- UCF Wrong Way Indication Beacon and Related Methods Patent No. 9,805,596, Published date: February 2, 2017, Issue date: October 31, 2017.
- UCF Wrong-Way Driving (WWD) HotspotsTM Methodology and Optimization Model
 - Identifying WWD hotspots for appropriate countermeasure treatment to produce the most cost efficient reduction in WWD crash risk. Won two best paper awards.



I-4 Segment WWD Crashes and WWD Crash Potential Risk in Central Florida





Low-cost sensor for air pollution measurement

Dr. Haofei Yu

- □ Traditionally, pollution concentration measured at stationary stations
 - Expensive, limited locations, need bulky/complex equipment and trained personals
- □ Low-cost and portable air pollution sensors have the potential to considerably enhance the capabilities of existing air pollution monitoring network
- □ Low maintenance and easy-to-use features of sensors also enable in-depth public participations in air quality research and advances citizen science





Civil Infrastructure Technologies for Resilience and Safety (CITRS)

CITRS Group

Safe, resilient, smart,

sustainable civil

infrastructure systems

bridges, buildings, highway

structures, pavements, roads, stadiums, convention centers, airports, ports, dams, tunnel, lifelines,

College of Eng nearing

Structural health monitoring and identification with novel sensing, analysis, and predictive analysis approaches



Non-destructive evaluation





Advanced modeling and analysis, multiple hazard assessment

Material-, component-, and large-scale testing





Novel and nanotech-based Kevin materials for civil infrastructure









Omer

UCF Civil, Environmental, and Construction Engineering NTRAL FLORIDA

UCF

assessment

and Computer Science eliability and probabilistic

Sustainable and gre

structures

Department of Civil, Environmental and Construction Engineering (CECE) Field Performance/Instrumentation of Geostructures/ Soil-Structure Interaction/Deep Excavations/Soil

Liquefaction/Soil Biocementation > Dr. Luis G. Arboleda-Monsalve

- Field performance and instrumentation of geostructures
- Soil-structure interaction
- Analysis and design of supported excavations
- Geotechnical earthquake engineering, soil liquefaction
- Advanced laboratory soil testing: residual, sedimentary, fly ash, biotreated sands
- Constitutive modeling of soils
- Static and dynamic stability of structures

Field performance and instrumentation



testing

Numerical simulations, advanced soil modeling

College of Engineering and Computer Science

Structural engineering future cities

Dr. Kevin Mackie, PE

□ Advanced materials, accelerated construction

- Composites and interfaces
- In-situ repair
- Accelerated construction, low maintenance
- Simulation and nonlinear analysis
 - Extreme hazards (earthquake, wind)
 - Designing for performance
- □ Reliability and uncertainty
 - > Updating performance with sensor data
 - Decisions under uncertainty













Civil, Environmental and Construction Engineering (CECE)

Computational Structural Mechanics

Georgios Apostolakis



Civil, Environmental and Construction Engineering (CECE)

Geospatial Data Science

- > Dr. Stephen Medeiros, PE
- **•** *Encoding the Environment*
- Mining Satellite and UAV Imagery, Laser Scanning Point Clouds, GPS, IoT sensor data ٠ using machine learning

Actionable Information for model parameterization and validation, change detection,



environmental and infrastructure monitoring











Kelly Kibler, PhD

- •EcoHydraulics •Hydrologic / Hydraulic Modeling •Flood Risk Assessment
- •Flow Prediction



Talea Mayo, PhD •Numerical Model Development •Uncertainty

Quantification •Risk Analysis

ayo, I Model ent Steven Duranceau, PhD, PE •Water Quality

•Water Quality and Treatment •Corrosion

•Direct Potable Reuse •Disinfection

Disinfection
 Byproducts



Dingbao Wang, PhD

•Surface Water & Groundwater Modeling

•Water Resource Systems

•Contaminant Transport Modeling



Arvind Singh, PhD •Sediment Transport

Network Dynamics
Geomorphology

A H M Anwar Sadmani, PhD •Membrane-based

& Hybrid Processes •Emerging Pollutants of Concern •Water Reuse Applications •Alternate Sources •Potable Water



Stephen Medeiros, PhD, PE

Hydrology / Hydraulics
Coastal Hydrodynamics
Remote Sensing & Lidar
Enginering / Industry / Business
Sensors and

Instrumentation

Thomas Wahl, PhD •Sea level rise and storm surges •Coastal flood and erosion risk •Multi-hazards •Extreme value analysis

Department of *Civil, Environmental and Construction Engineering (CECE)*

- □ Hydrology and Water Resources
 - Dingbao Wang



Climate Change and Sea Level Rise impacts on Coastal Hydrology







Drinking Water Infrastructure Research at UCF



Photo: Dr. Duranceau works with doctoral student and NSF Fellow Ms. Rodriguez conducting HPLC analysis in the laboratory.



(Above) Dr. Duranceau and two graduate students preparing to collect water samples at Fena Lake at the U.S. Naval Base on the island of Guam.

<u>Summary</u>: Dr. Duranceau's research focuses on the quality of supply, treatment, distribution and storage of potable (drinking) water and its' infrastructure, with specialized expertise in coastal and island water supplies. His research garners approximately \$400,000 per year of funding that has generated 11 doctoral and 13 master degree graduates over the past decade. His applied water treatment operations studies fill an emerging need demanded in today's increasingly complex municipal infrastructure climate that requires economic, social (health) and environmental multi-disciplinary approaches necessary to provide solutions to a number of challenging problems.



Photo: UCF's Operations Research Activities at Jupiter (FL) Nanofiltration Full-Scale and Pilot-Scale Process

Funding Agencies (partial listing):

- Florida
 - City of Boynton Beach
 - City of Delray Beach
 - City of Sarasota Utilities
 - Jupiter Water Utilities
 - Orange County Utilities
 - Polk County Utilities
 - Sarasota County Utilities
- Georgia
 - Butts County Water & Sewer Authority
- California
 - Alameda County Water District
- Hawaiian Islands
 - County of Maui Water Supply (Maui)
 - Pulama Lanai Water (Lanai)
- Marianas Islands Guam (U.S. Navy)
- Cayman Islands (Water Research Foundation)
- National Science Foundation
- U.S. Department of Agriculture



(Left) Dr. Duranceau's research team is internationally recognized for their work related to drinking water quality and treatment.



(Above) Another area of specialization is UCF's drinking water research that involves the investigation of reverse osmosis desalination processes to treat brackish and sea water supplies.



(Above) Dr. Duranceau's research team is recognized for their work related to internal and external corrosion of water distribution infrastructure.



Department of Civil, Environmental and Construction Engineering (CECE)

- Environmental Sustainability Assessment
 - Omer Tatari





Civil, Environmental, and Construction Engineering (CECS)

- □ Hydroenvironmental Systems Research
 - ➢ Ni-Bin Chang

Rule-based Decision Support Systems for Watershed Management and Drinking Water Infrastructure Assessment Stormwater Nutrient Control with Floating Treatment Wetland, Biosorption Activated Media, and other Best Management Practices Multi-Sensor Satellite Image Fusion, Data Mining, and Networking for Environmental Systems Analysis









Civil, Environmental and Construction Engineering (CECE)

Environmental Biotechnology, Nutrient and Energy Recovery from Water/Wastewater

Dr. Andrew Randall, PE

- Biotransformation of Biodiesel waste for Biological Nutrient Removal (advanced – wastewater treatment) and other applications
- Dynamic (empirical/process) and Metabolic (mechanistic/biochemical) modeling for Biological Nutrient Removal
- Biotransformation and adsorption for Nutrient Removal from Stormwater
- Graywater reuse
- □ Water distribution system biostability
- Cometabolism of chlorinated solvents







Microsensor Biofilm Research Dr. Woo Hyoung Lee





Civil, Environmental and Construction Engineering (CECE)

- Environmental Engineering: Membrane Treatment of Emerging Micropollutants
 - Anwar Sadmani
 - Optimization of the removal of "emerging" micropollutants (pharmaceuticals, personal care products, industrial additives) from surface waters within the context of the entire treatment train when using high and low pressure membranes
 - Quantitative evaluation of membrane performance based on the composition of surface water to be treated and the physicochemical properties of target contaminants
 - Investigation of the application and efficiency of forward osmosis and other membrane-based hybrid processes, in various combinations, treating impaired quality waters (focusing on the removal of micropollutants).



Civil, Environmental and Construction Engineering (CECE)

- Landfill Research
 - Dr. Debra R. Reinhart, PE
 - CHALLENGES: Landfill emissions must be controlled to ensure minimal environmental impacts. The residues left in landfills should not pose unacceptable risk to the environment.
 - APPROACHES: Bioreactor landfills, diversion of rapidly degradable food, improve gas collection, control refractory materials, improve post-closure land use, understand fate of new materials



Leachate Treatment



Landfills as

Energy Parks

in leachate

Nanoparticles





CECS Research Facilities and State-of-the-Art Laboratories

Department of Civil, Environmental, and Construction Engineering (CECE)

- Smart Cities lab
- Microsensor Biofilm Research Laboratory
- Center for Hydroscience Analysis, Modeling, & Predictive Simulations
- Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) instrument to be housed soon to strengthen cutting edge researches involving the analysis of trace level micropollutants in water
- Rainfall and sinkhole simulators
- Transportation Simulation Lab



Notable CECS Graduate Alumni

Department of Civil, Environmental, and Construction Engineering (CECE)

Isabel Escobar, **Professor**, Department of Chemical and Materials Engineering, University of Kentucky, Lexington, Kentucky

• Center of Membrane Sciences Faculty: KY National Science Foundation EPSCoR Membrane Pillar Faculty

Nicole Berge, Associate Professor, Civil and Environmental Engineering Department, University of South Carolina, Charleston, South Carolina

• National Science Foundation CAREER grant recipient

Dr. Sherif Ishak, Chair Civil Engineering Dept, University of Alabama

Dr. Xuedong Yan, Associate Dean, School of Transportation Engineering, Beijing Jiaotong University



Department of Civil, Environmental, and Construction Engineering (CECE)

Notable CECS Graduate Alumni

Anurag Pande, Associate Professor, Department of Civil Engineering, Cal Poly, San Luis Obispo, CA

Xuesong Wang, Professor, School of Transportation Engineering, Tongji University, China

Rongjie Yu, Associate Professor, School of Transportation Engineering, Tongji University, China

Mohamed Ahmed, Assistant Professor, Department of Civil & Env. Engineering, University of Wyoming

Albinder Dhindsa, CEO and founder, Grofers, On Demand Delivery Service for Indian Cities

Jeremy Dilmore, FDOT District 5, Head of ITS Office



CECS Graduate Students Entering the Workforce Potential Jobs in Industry, Government and Academia

Department of Civil, Environmental, and Construction Engineering (CECE)

Employers of Graduates

Consulting/Design Firms U.S. Geological Survey National Oceanic and Atmospheric Administration DOE National Labs Water Management Districts Universities

Federal Highway Administration Departments of Transportation Water and Wastewater Utilities Federal and State Regulatory Agencies



CECS Editors and Associate Editors

Department of Civil, Environmental, and Construction Engineering (CECE)

- Ni-Bin Chang
 - Editor-in Chief, Journal of Applied Remote Sensing, Jan., 2014-today, published by International Society of Optics and Photonics (SPIE).
 - > Associate Editor-in-Chief, *Frontiers of Earth Sciences*, Feb., 2011-today, published by Springer.
 - Associate Editor, Journal of Environmental Informatics, Sept., 2006-today, published by the International Association of Environmental Information Management (ISEIS).
 - Associate Editor, *IEEE Systems Journal*, May, 2014 present, published by the Institute of Electrical and Electronics Engineers (IEEE).
 - Associate Editor, Journal of Water Quality, Exposure and Health, Oct., 2007-today, published by Springer.
 - Associate Editor, International Journal of Environmental Science and Technology, June, 2011today published by Springer.
- Mohamed Abdel-Aty
 - Editor-In-Chief: Accident Analysis & Prevention



CECS Editors and Associate Editors

Department of Civil, Environmental, and Construction Engineering (CECE)

- Steven Duranceau
 - Associate Editor, Desalination and Water Treatment (Taylor and Francis)
 - Editorial Board Member, Membranes (MDPI).
- Haitham Al-Deek
 - Assoc. Editor: Journal of Intelligent Transportation Systems
- Debra Reinhart, Associate Editor
 - > Waste Management
- Dingbao Wang
 - **Guest Editor**: *Hydrology and Earth System Sciences*



CECS Faculty Honors/Society Fellowships Department of Civil, Environmental, and Construction Engineering (CECE)

National Academy of Engineering

Nicholas Garber

American Association for the Advancement of Science

Ni-Bin Chang, Debra Reinhart

American Society of Civil Engineers

Necati Catbas, Ni-Bin Chang, Essam Radwan, Debra Reinhart, Ola Nnadi

Early Career Honors

> NAE Frontiers of Engineering; Necati Catbas (FOE-U.S.-Europe)



CECS University Honors

Department of Civil, Environmental, and Construction Engineering (CECE)

Trustee Chair

Mohamed Abdel-Aty

UCF Pegasus Professors

Mohamed Abdel-Aty, Debra Reinhart, Martin Wanielista (Emeritus)

