

Overview of Carnegie Mellon Civil and Environmental Engineering Department

Spring 2011

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The Vision for this Department is...

to continue to achieve national and international recognition through the impact of its research and alumni in four core areas:

- advanced infrastructure systems;
- mechanics, materials and computing;
- water and air quality; and
- green design.

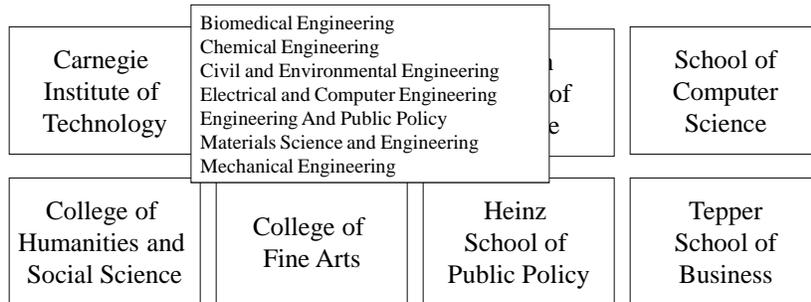
Our vision includes our department being a collegial, collaborative and welcoming environment in which to learn and work.



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CEE, CIT and the University



CIT = Carnegie Institute of Technology, the Engineering College

CIT is about ~25% of Carnegie Mellon

CEE is about ~10% of CIT



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What Makes CEE@CMU Unique?

- Remain highly ranked program with smaller number of faculty, staff and student body than most peers (USNWR Grad Rankings: 7 EE, 10 CE)
- Faculty distributed in a few areas of comparative advantage
 - AIS, EESM, MMC, and GD
 - Unique foci when compared to more traditional departments
- Systemic interdisciplinarity in research and educational activity
 - 4 joint appts, many co-advised students, a significant amount of research in units outside of CEE
- Extensive research center activity associated with department (9 centers)
- Significant external recognition for work in these areas
 - national awards, journal editorships, conference chairs, competitive in national grant competitions.



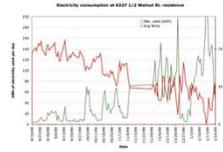
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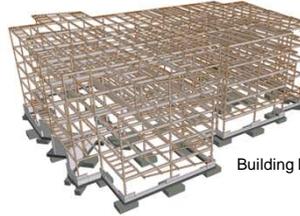
CEE Graduate Programs – AIS and GSC

This program focuses on planning, design, construction, and operation of built infrastructure:

- 1) **sensing and informatics** for the construction, operation and maintenance phases of infrastructure;
- 2) **new models, methods and tools** for planning, design, construction and facility management; and
- 3) developing **more sustainable processes and components** used in the built infrastructure.



Monitoring Electricity Consumption of Buildings



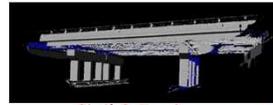
Building Information Modeling



New Sensors for civil infrastructure applications. Acoustic emission sensing is used to detect flaws or fatigue cracks in steel structures and piezoelectric transducers for detection of defects in natural gas pipelines



Exploring the use of **laser scanners and embedded sensors during the construction process** for the purpose of identifying and classifying construction deviations.



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CEE Graduate Programs - GD

Focuses on education and research to link responsible social and environmental stewardship with the design and engineering of products and systems

- 1) **sustainable infrastructure**
- 2) **energy and environment**
- 3) **carbon footprinting**
- 4) **life cycle assessment, and**
- 5) **education and outreach**



Green Design Apprenticeship program introduces environmental system problem solving skills to local high school students



Assessing the areas of product and infrastructure life cycles with the greatest environmental and energy impacts, e.g. life cycle infrastructure effects of various alternative fuel pathways.



Calculation of a company's carbon footprint often accounts for direct emissions from the firm's operations and for the energy consumed, perhaps from a coal-burning power plant like the one here. But these are not the only factors in the total carbon footprint.



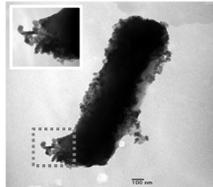
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CEE Graduate Programs - EESM

This program focuses on:

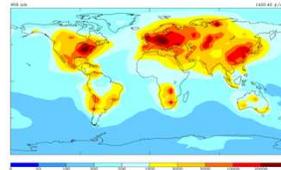
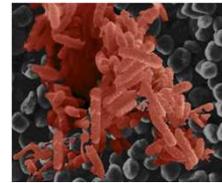
- 1) air quality
- 2) environmental management, and
- 3) water, soil, and sediment quality

Sensor Networks for Monitoring Regional Water Quality. In Collaboration with the River Alert Information Network (RAIN), evaluating total dissolved solids in the Monongahela River and the relationship of bromide precursors to high disinfection by-product formation in regional drinking water distribution systems.



Environmental Implications of Nanotechnology. Elucidate the properties of engineered nanomaterials that determine their environmental fate, transport, and effects.

Bio-energy. Certain bacteria, known as electricigens, can couple their metabolism with electricity production while growing on electrodes.



Airborne Particulate Matter. Atmospheric particles are associated with significant public health problems and are also agents of climate change. These impacts are studied through laboratory studies, ambient monitoring, and computer modeling.



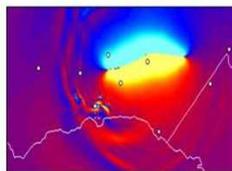
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CEE Graduate Programs - MMC

Focuses on modeling and large-scale computer simulation, with emphasis on

- 1) **mechanics of crystalline, granular, and amorphous materials** from atomistic to macroscopic scales;
- 2) **engineering seismology, and**
- 3) **earthquake engineering**



Snapshot of displacement profile due to an earthquake dislocation in Southern California

Field theory prediction of location, sequence, and type of partial dislocation nucleation in fcc Ni, validated against lattice statics calculation

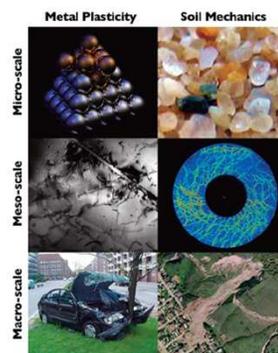
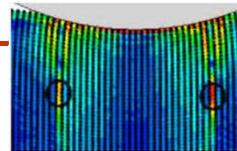


Figure 1: Multiple scales involved in macroscopic phenomena of interest



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CEE-Related Research Centers

- Brownfields Center
 - Director: Lange
- CAPS: Center for Atmospheric Particle Studies
 - Director: Donahue (ChemE)
- CEINT: Center for Environmental Implications of Nanotechnology
 - Director of CMU Activity: Lowry
- CenSCIR: Sensed Critical Infrastructure Research
 - Co-directors: Garrett and Moura (ECE)
- CM2EM: Center for Multiscale Modeling of Engineering Materials
 - Director: Acharya
- Green Design Institute
 - Co-directors: Hendrickson and Lave (Tepper)
- CSE: Center for Sustainable Engineering
 - Director: Davidson
- SEER: Steinbrenner Environmental Education and Research Institute
 - Director: Dzombak
- WaterQUEST: Urban Water Quality
 - Director: VanBriesen



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CEE Faculty/Student Statistics for 2010/11

22 Faculty Members

(19 FTE)

(~12% of CIT)

125 undergraduate students

(~7% of CIT)

144 FTE graduate students

(~10% of CIT)



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Questions?



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