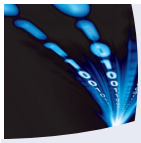
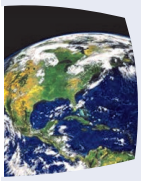
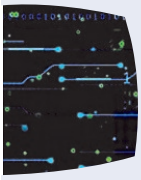






Presented By:

Ni-Bin Chang, Ph.D.

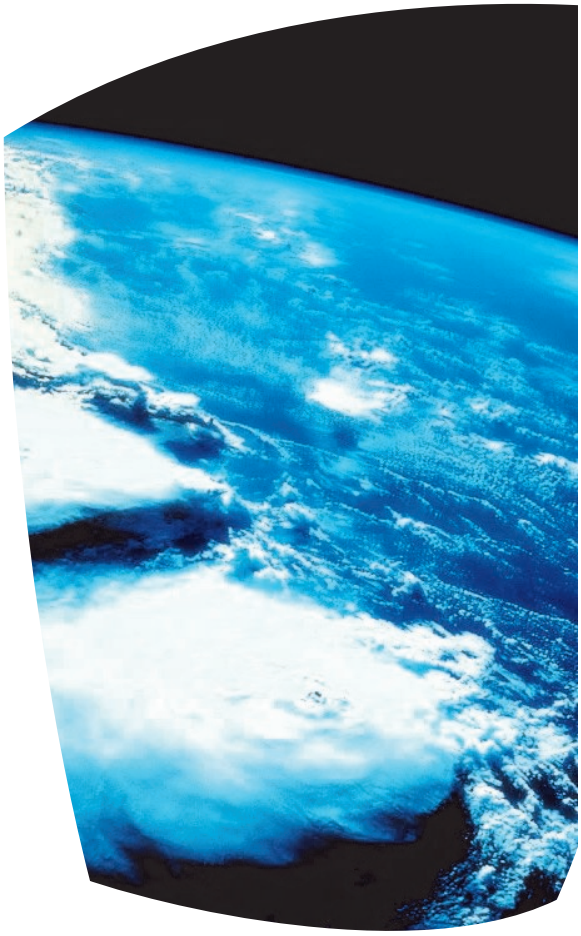
Program Director of the Hydrologic Sciences Program & Cyber-Innovation Sustainability Science and Engineering Program - **National Science Foundation**

Stormwater Management Academy - Department of Civil, Environmental & Construction Engineering - **University of Central Florida**

Environmental Engineering *Seminar Series*

Friday, May 23rd, 2014
McDonnell Douglas Auditorium (MDEA)
1:30PM-2:20PM

Cyber-Innovation Sustainability Science & Engineering: A New Paradigm Under the Global Change Impact



Sustainability Science and Engineering (SEES) that is deemed as a new paradigm under global change era has been receiving wide attention since 2003. This presentation will the latest forefront of SEES education and research. A case study using Lake Erie water quality monitoring will be presented as an example of Cyber-Innovation Sustainability Science and Engineering (CyberSEES). As we know of, the frequencies of occurrence of Harmful Algal Bloom (HAB) events in Lake Erie and elsewhere may be tied to an integrated response of climate change impact (temperature change) and anthropogenic disturbance (changing nutrient cycling). Blue-green algae or cyanobacteria are photosynthetic bacteria that require little energy for cell maintenance and growth, giving them a distinct advantage over competition. Urban growth and agricultural production have caused an influx of nutrients into Lake Erie, leading to eutrophic zones. These conditions result in the formation of algal blooms, some of which are toxic due to the presence of *Microcystis* (a cyanobacteria), which produces the hepatotoxin microcystin. *Microcystis* has a unique advantage over its competition as a result of the invasive zebra mussel population that filters algae out of the water column except for the toxic *Microcystis*. The toxin threatens human health and the ecosystem, and it is a concern for water treatment plants using the lake water as a tap water source. This paper demonstrates the prototype of a near real-time early warning system using Integrated Data Fusion and Mining (IDFM) techniques to determine spatiotemporal microcystin concentrations and by measuring the surface reflectance of the water body using satellite sensors. The fine spatial resolution of Landsat is fused with the high temporal resolution of the Moderate Resolution Imaging Spectroradiometer to create a synthetic image possessing algorithm producing images with both high temporal and spatial resolution. As a demonstration, the spatiotemporal distribution of microcystin within western Lake Erie is reconstructed using the band data from the fused products and applied machine-learning techniques. Analysis of the results through statistical indices confirmed that the genetic programming model has potential to accurately estimating microcystin concentrations in the lake, which is better than all current 2-band and 3-band models and other computational intelligence models via IDFM. Future work will touch the framework of integrated sensing, monitoring and modeling for decision making.

Speaker Bio

Dr. Chang received a B.S. degree in Civil Engineering from National Chiao-Tung University in Taiwan in 1983, and M.S. and Ph.D. degrees in Environmental Systems Engineering from Cornell University in 1989 and 1991, respectively, in the U.S. Since 1992, Chang has been directing academic research in the core area of "Environmental Sustainability, Water Resources Management, and Systems Analysis" based on various socio-technical system of systems engineering approaches. With the formation of many cross-domain teams, Chang's research areas include sustainable systems engineering, sustainability science, environmental and hydrological informatics/systems analysis, remote sensing and sensor networks, soft computing/ computational intelligence, industrial ecology, ecological engineering, green infrastructure planning and design, and system control/engineering optimization.