Announcing the Final Examination of Anthony Crawford for the degree of Master of Science

Time & Location: October 20, 2014 at 4:00 PM in ENGR 2 211
Title: Green Technology and Sensor Networks for BMP Evaluation in Stormwater Retention Ponds and Constructed Wetlands

The aim of this thesis is to examine and develop new techniques in stormwater Best Management Practices (BMP) for nutrient and erosion reduction and monitoring. Previous research has found that excessive nutrient loading of nitrogen and phosphorus species from urban stormwater runoff can lead to ecological degradation and eutrophication of receiving lakes and rivers. Effective stormwater management implementations can help reduce such loading rates, however may not be sufficient in meeting water quality goals set forth by Total Maximum Daily Loads (TMDLs). In order to reach these goals technologies designed for both reducing nutrient loading and monitoring of system performance are required.

Firstly this thesis examines the performance of three types of continuous-cycle Media Bed Reactors (MBRs) using Bio-activated Adsorptive Media (BAM) for nutrient reduction installed in three retention ponds located throughout the Central Florida region. Each MBR was analyzed for performance in reducing total phosphorus, soluble reactive phosphorus, total nitrogen, organic nitrogen, ammonia, nitrates + nitrites, turbidity and chlorophyll a species from the retention pond. The results of the experiments indicated that the MBRs can be combined with retention ponds to provide a “green technology” inter-event treatment of nutrient species in urban stormwater runoff.

Secondly the thesis focuses on three new devices for BMP monitoring, including an Arc-Type Automated Pulse Tracer Velocimeter (APTV) for low velocity and direction surface water measurement installed in a retention pond and constructed wetland, a Groundwater Variable Probe (GVP) for velocity, hydraulic conductivity and dispersion measurements in retention pond bank, and finally an affordable Water Autosampling Network (WAN) for sampling and analysis of nutrient flux gradients in retention ponds. The Arc-Type APTV was found to work effectively in both lab and field environments from a 0.02 - 5.0 cms-1 range and measure velocity within approximately ±10% of an acoustic Doppler velocimeter and within an average of ±10° of directional measurements. A drop in accuracy was measured for velocity ranges >5.0cms-1. Two methods for velocity calculation were developed for the GVP for low flow (Pe < 0.2) and high flow (Pe > 0.6) conditions. The GVP was found to operate from a 26-505 cmd-1 range in the laboratory to within ±26% of expected velocities for high-flow conditions and effectively measure directional flow angles to within ±14° of expected. Hydraulic conductivity measurements made by the GVP were confirmed to within ±12% as compared to laboratory measurements. The GVP was found to be capable of measuring the dispersion coefficient in the laboratory, however turbulent interferences caused during injection was found to occur. The WAN was found to effectively operate by text activation in the field to within a range of 200 feet and collect 50 ±4.3XXml samples at timed increments. A tracer study confirmed that no mixing of samples occurs when a factor of safety of 2 is applied to flush times.

Major: Environmental Engineering

Educational Career:
Bachelor’s of Environmental Engineering, BS, 2010, University of Central Florida

Committee in Charge:
Ni-Bin Chang, Chair, CECE
Martin Wanielista, Co-Chair, CECE
Woo Hyoung Lee, University of Central Florida CECE Department

Approved for distribution by Ni-Bin Chang, Committee Chair, on September 27, 2014.
The public is welcome to attend.