Announcing the Final Examination of Don Graham for the degree of Doctor of Philosophy

Time & Location: November 1, 2013 at 9:00 AM in Engineering II 211P
Title: A Comparative Evaluation of FDSA, GA, and SA Non-Linear Programming Algorithms and development of system-optimal methodology for Dynamic Pricing on I-95 Express

As urban population across the globe increases, the demand for adequate transportation grows. Several strategies have been suggested as a solution to the congestion which results from this high demand outpacing the existing supply of transportation facilities.

High Occupancy Toll (HOT) lanes have become increasingly more popular as a feature on today’s highway system. The I-95 Express HOT lane in Miami Florida, which is currently being expanded from a single Phase (Phase I) into two Phases, is one such HOT facility. With the growing abundance of such facilities comes the need for in-depth study of demand patterns and development of an appropriate pricing scheme which reduces congestion. This research develops a method for dynamic pricing on the I-95 HOT facility such as to minimize total travel time and reduce congestion. We apply non-linear programming (NLP) techniques and the finite difference stochastic approximation (FDSA), genetic algorithm (GA) and simulated annealing (SA) stochastic algorithms to formulate and solve the problem within a cell transmission framework. The solution produced is the optimal flow and optimal toll required to minimize total travel time and thus is the system-optimal solution. We perform a comparative evaluation of FDSA, GA and SA non-linear programming algorithms used to solve the NLP and the ANOVA results show that there are differences in the performance of the NLP algorithms in solving this problem and reducing travel time. We then conclude by demonstrating that econometric forecasting methods utilizing vector autoregressive (VAR) techniques can be applied to successfully forecast demand for Phase 2 of the 95 Express which is planned for 2014.

Major: Civil Engineering

Educational Career:
Bachelor's of Electrical Engineering, BS, 1989, University of Florida
Master's of Operations Research, MS, 1994, Columbia University

Committee in Charge:
Essam Radwan, Chair, Civil, Environmental, and Construction Engineering
Haitham Al-Deek, Civil, Environmental, and Construction Engineering
Mohamad Abdel-Aty, Civil, Environmental, and Construction Engineering
Nizam Uddin, Statistics

Approved for distribution by Essam Radwan, Committee Chair, on October 17, 2013.

The public is welcome to attend.