UNIVERSITY of HOUSTON | ENGINEERING

Department of Industrial Engineering

Wednesday, December 9, 2020

1:00 PM – 4:00 PM CST

Zoom link: https://uofh.zoom.us/j/98307427249
Meeting ID: 983 0742 7249

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Ph.D. Dissertation Defense
Advisor: Dr. Gino J. Lim

"Emergency Evacuation Planning Problem under Uncertainty in Events"

Abstract

Large-scale emergency evacuations in the wake of hazards such as hurricanes, tsunamis, volcanic disruptions, nuclear meltdowns, etc., are crucial part of disaster management. Due to the unpredictable nature of disasters, an evacuation plan can heavily be affected by uncertainty in events. The resulting deviations can contribute to road congestions, prolonged evacuation process, unstable traffic behaviors, and lead to chaos, injuries, and loss of life. Two approaches can be taken to handle the uncertainties. First, developing evacuation route plan and schedule prior to the arrival of the adversarial event by considering the risk of exposure to disaster impact (pro-active planning); and, Second, monitoring the progress of the evacuation, detecting deviations, and making adjustments if needed (recovery strategy). Our proposed research focuses on developing pro-active plans and recovery strategies to handle associated uncertainties that are either due to the occurrence of probable incidents, or randomness in data. Using theory of dynamic network flow optimization we provide: (i) A framework for real-time evacuation reroute planning as a recovery strategy in response to unforeseen road capacity disruptions; (ii) A two-stage pro-active stochastic model for evacuation planning with the ability to adjust the pan robustness under probable road disruptions; (iii) A distributionally robust chance-constrained program to provide pro-active evacuation plans under ambiguity of probability distribution function of road distribution times (assuming only moment information is available); (iv) A pro-active data-driven robust optimization framework using a generalized intersection kernel support vector clustering (SVC) to build the uncertainty sets that efficiently capture distributional geometry of massive demand data; (v) A pro-active data-driven robust optimization framework using intersection of the previous uncertainty set (SVC-based) and a conventional robust optimization uncertainty set (e.g., box uncertainty set) to reduce solution conservatism.