Macroscopic Modeling of Cyber-Attacks in Multi-Vehicle Systems

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ABSTRACT:

In this talk, we address the modeling and analysis of cyber-attacks in multi-vehicle systems such as streams of autonomous cars and swarms of UAVs, by using Partial Differential Equations (PDEs). In autonomous cars, we consider scenarios wherein a group of malicious vehicles on a highway perform a cooperative attack with the motive of creating undesirable wave effects among other vehicles on the highway, with the intention to either deliberately induce pile-up crashes, or cause vehicles to be stuck in traffic and thereby cause an economic impact in terms of lost time. In UAV swarms, we consider scenarios wherein a hacker hacks into a subset of UAVs in a swarm and turns them into vehicles with malicious intent, with the intention to prevent the swarm from performing its intended mission. In both cases, the underlying PDE model is a two-species model with the two species being malicious vehicles and the normal vehicles, along with their underlying interaction effects.

BIOGRAPHY:

Dr. Animesh Chakravarthy is an associate professor in the Department of Mechanical and Aerospace Engineering at University of Texas Arlington. He holds a Ph.D. in Aeronautics/Astronautics Engineering from the Massachusetts Institute of Technology. His current research interests include PDE-based modeling of multi-agent systems, collision avoidance, flight dynamics and control of morphing aircraft, and prediction of aircraft loss of control. His research has been funded by NSF, NASA, FAA and the U.S. Air Force. He is a recipient of a NSF CAREER Award and has also been an AFRL Summer Faculty Fellow.