**Control, Decision, and Optimization Methods for Unmanned Systems and Swarm Dynamics**

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**Abstract:** Control, decision making, and optimal sensing for autonomous unmanned systems (e.g., drones or drone swarms) has applications in defense and civilian sectors such as target detection and tracking, surveillance, payload delivery, infrastructure inspection, and precision agriculture. In these problems, we face challenges such as solving nonlinear and non-convex optimization problems, uncertain and partial state information, and stochastic system dynamics. In this talk, I will present decision theoretic formulations and fast heuristic methods to address these challenges, and specifically solve optimal motion planning and sensor fusion problems in various contexts such as unmanned aerial vehicle autonomy, swarm autonomy, and sensor fusion. I will discuss applications such as target tracking, surveillance camera control, 3-D object shape reconstruction, and radar code design. The above problem scenarios often lead to optimization problems that live in high dimensional spaces, which are hard to solve exactly. We discuss certain approximate dynamic programming methods to solve these problems approximately. Certain other optimal sensing problems lead to NP-hard optimization problems; we discuss polynomial-time heuristic methods to solve these problems approximately and present performance bounds for these methods.



**Biography:** Dr. Shankarachary Ragi received his bachelor’s and master’s degrees in Electrical Engineering from Indian Institute of Technology Madras (IIT Chennai, India) in 2009. He earned his doctoral degree in Electrical and Computer Engineering from Colorado State University in 2014. After briefly working in industry post Ph.D., Dr. Ragi joined the mathematics department at Arizona State University in 2016 as a postdoctoral research associate. He is currently an assistant professor in the electrical and computer engineering department at South Dakota School of Mines and Technology. His research is primarily focused on autonomous unmanned systems and swarm intelligence, and deals with various aspects such as optimal decision making, motion planning, sensor fusion, and swarm tactics. Dr. Ragi serves on the editorial board for IEEE Access.

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