SOUTH DAKOTA MINES
Department of Mechanical Engineering

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THURSDAY, SEPTEMBER 17 2:00-2:50 PM

ME Research Seminar

Multi-Agent Autonomous Guidance Navigation & Control

Using SVGS Vision Sensor for Lunar Surface Mobility Applications

DR. HADI FEKRMANDI
SOUTH DAKOTA MINES

Dr. Hadi Fekrmandi, PE, joined the Department of Mechanical Engineering in Fall 2017 as an assistant professor. His areas of expertise include emerging areas of control and intelligent mechatronics systems. He teaches undergraduate and graduate level courses related to modeling, design, and implementation of control systems. Dr. Fekrmandi's current research interests are: (a) machine learning and artificial intelligence for developing fault detection, identification, and recovery (FDIR) in autonomous robots; (b) distributed state estimation and control of cooperative autonomous multi-agent systems (MAS) for hazardous/remote-to-access domains. At the South Dakota Mines Advanced Intelligent Mechatronics (AIM) research lab, Dr. Hadi Fekrmandi is leading research projects and collaborating with South Dakota Mines faculty with a focus on developing research and educational partnerships with federal agencies and research centers, state universities, and private industry.

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in-person: CM 266 (capacity 16)
Live *Zoom!* LINK: tiny.cc/MinesF20

A fundamental problem in autonomous multi-agent systems (MAS) is to design a mechanism of state estimation and decision making within agents so that the overall performance of the system is reliable. Control and coordination of a team of mobile robots for cooperative function in harsh and remote to access environments is more challenging than the MAS systems on earth surface. This is due to the unique communication characteristics, the random interference of various obstacles, and the uncertainties encountered in such an unknown environment. Specifically, this research aims to develop a decentralized state estimation for robots operating in challenging domains of space and undersea. In centralized state estimation, the agents communicate their observations to a central node where an estimate of MAS is calculated based on the collective information. However, this is not always feasible due to communication link failures and bandwidth and range constraints in harsh domains; nor is it always desirable as doing so will compromise reliability by introducing a single point of failure. The alternative approach (i.e. distributed state estimation [DSE]) adopts a message passing protocol between agents and strives to achieve similar results of the centralized estimation via a distributed process. The DSE method is shown to be well-suited to particularly to multi-agent applications of interest since the algorithm is scalable, robust to network failure, capable of handling non-Gaussian transition and observation models, and, crucially, no global knowledge of the communication network is ever assumed.