ME Seminar

Formally verified controllers for cyber-physical systems

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ABSTRACT

Due to the increasing level of autonomy and rapid technological advancements in sensing, computing, and communication, nowadays many real-world applications are expected to do complex tasks. These complex tasks can be formally represented using temporal logic specifications or an (in)finite strings over automata. On the other hand, the modeling complexities in real-world applications, such as combination/interconnection of physical and cyber components, noisy dynamics, dependency on state history, lack of knowledge of the exact mathematical model, interconnection between subsystems, constraints posed by implementing hardware platforms, are increasing. These system-level complexities along with task-level complexities make the formally correct synthesis of control algorithms very challenging. Solving this problem is beyond the scope of conventional control theory and needs to utilize some concepts from computer science. In this talk, I will discuss my research contributions on combining knowledge from different theories of control systems and computer science to synthesize *formally verified controllers* for complex control systems (i.e., containing the aforementioned modeling complexities) that ensure the satisfaction of *complex logical specifications*.

ABOUT THE SPEAKER

Pushpak Jagtap is an Assistant Professor in Robert Bosch Center for Cyber-Physical Systems at the Indian Institute of Science (IISc) Bangalore. Before joining IISc, he was a post-doctoral researcher at the KTH Royal Institute of Technology in Sweden. He received Ph.D. in electrical and computer engineering from the Technical University of Munich and an M.Tech. in electrical engineering from the Indian Institute of Technology, Roorkee. His research area focuses on formal analysis and control of autonomous systems, control theory, cyber-physical systems, and learning-based control. He was recently awarded Google India Research Award 2021 for his research works.

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