

The Center for Control, Dynamical Systems, and Computation Spring Seminars Presents



Knowledge is a Terrible Thing to Waste: Using Formal Reasoning about Knowledge and Inference in Discrete-Event Control

by

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Abstract:

Discrete-event systems are processes whose behaviour can be characterized by sequences of events and can be represented by finite-state automata or directed graphs. Control problems arise because the systems can generate undesirable sequences. Work in this area typically addresses when it is possible to derive agents that can prohibit bad sequences. These problems are more difficult computationally if they must be solved using decentralized control, where each agent has only a partial view of overall system behaviour. Recently, a mathematical theory of knowledge, as developed by Halpern & Moses, has been used to model distributed systems. This theory provides a formal way to reason about what processes “know”. The model is based on a modal logic and uses Kripke structures, which provide visual pictures of what each agent “knows” and “does not know”. Using this formalism, we model decentralized discrete-event problems. We show that problem solution amounts to determining whether for each required action, at least one agent “knows” what event to disable. The framework is also extended so that when a supervisor cannot make a definitive control decision based on its own knowledge (or direct observations) of the system, the supervisor may reason about whether other supervisors have sufficient knowledge to eventually make the correct control decision. In this way, supervisors use inference and a broader set of possible control actions to jointly solve a problem.

This is joint work with S. Laurie Ricker (Mount Allison University, Canada).

About the Speaker:

Karen Rudie received her PhD in 1992 in the Systems Control Group at the University of Toronto, under the supervision of Murray Wonham. She is currently an associate professor in the Department of Electrical and Computer Engineering at Queen's University, in Canada. She is also cross-appointed to the School of Computing there. Her research focuses on the control of discrete-event systems.
