Zhiwu Li

1. Optimal Deadlock Control of Automated Manufacturing Systems Using Petri Nets: A Reachability Graph Approach

Abstract： For the deadlock problem in automated manufacturing systems, a deadlock prevention and control method based on Petri net reachability graph analysis is introduced. The reachability graph of a Petri net model is dichotomized into legal and deadlock zones; the concept of first-met bad markings is proposed. The use of vector covering effectively reduces the number of constraints and variables of the linear programming problems formulated for an optimal controller design, making the reported methods applicable to large-scale systems. Finally, the idea of vector covering is applied to general Petri net models to solve the supervision and control problem of unstructured net systems. A number of future research directions in this line are touched upon.

2. Fault Diagnosis of Discrete Event Systems

The talk begins by reviewing the classical fault diagnosis approach based on finite state automata (FSA). It then transitions to a more efficient methodology centered on Petri nets, with a particular focus on the basis marking approach. This method leverages the structural properties and marking reachability analysis of PNs to construct a compact diagnoser, significantly reducing computational complexity compared to enumerating the full reachability graph. For diagnosability enforcement through supervisory control theory, we synthesize a supervisory controller, based on the diagnosed fault information and the system model, to dynamically restrict the system's behavior. It is demonstrated that the Petri net formalism, combined with supervisory control, provides a powerful and structurally insightful framework for both diagnosing faults and proactively enforcing desired diagnosability properties in complex discrete event systems.

Statement about availability for delivering lectures.

Normally I am available from June 1 to August 31, 2006 and Nov. 15 to December 20.