Design and Specification of Low-Level Control Softwares for FMC using Supervisory Control Theory

Sangkyun Kim, Jin Woo Park

Dept. of Industrial Eng., Seoul National Univ.

ABSTRACT

This research is concerned with the development of a formal procedure for the design of a control software in an FMC environment. As FMCs come in various configurations and impose peculiar control requirements, it is difficult to develop a design procedure that is applicable to all situations. To cope with such problems we used a finite state automata as a prime modeling tool for FMC and utilized the supervisory control theory under the framework of Ramadge and Wonham to resolve the logical problems associated with the asynchronous behavior of cell components. We also proposed a controller architecture based on the cell supervisor. In addition, we proposed an abstract formalism called CS structure as a conceptual aid in specifying the event-driven operation of the cell controller. Adaptive supervisor and event queue concepts are also presented to overcome the complexity problem and synchronization problem caused by the violation of the instantaneity assumption of theory in real life situation, respectively. Supervisor synthesis process for the machining cell of a real FMS is presented as an example.

Key Words : Design and Specification, FMC Control Software, Supervisory Control, Finite State Automata