DESIGN, IMPLEMENTATION AND SIMULATION OF A HYBRID ARCHITECTURE FOR THE CONTROL OF SCHEDULING ACTIVITIES IN AN FMS

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Abstract

An alternative architecture for the control of scheduling activities in an FMS shop floor, called Hybrid Control Architecture, is being researched at Massey University, Palmerston North. The architecture incorporates the strengths of the four standard FMS control architectures: centralised, hierarchical, modified hierarchical and heterarchical. The objective is to maximise the advantages associated with these existing architectures and minimise their problems.

The major characteristics of the hybrid control architecture are levels of control with a single supervisor, full autonomy for subordinates, full intelligent entities and simplicity in scheduling. The architecture offers prospects of decomposition of the control problems, reduced control system complexity by localising information without eliminating global information, increasing modifiability and possible gradual implementation.

The method used for scheduling jobs is the "hybrid" auction-based scheme wherein the top level (the shop controller) acting as the centralised auctioneer and awards the processing of a task to the work centre with the best bid. The "hybrid" auction-based scheme is a part of a three-level scheduling framework: task selection, bidding function and local scheduling. Such a scheduling scheme provides an opportunity to incorporate different dispatching heuristics to achieve a global goal.

To study the scheduling aspect of the hybrid control architecture, a simulation package serving two functions - the control facility and simulator - is developed. The modelled FMS shop floor and the auction-based sequencing functions of the shop, cell and machine controllers are constructed using a real-time control software. A windows programming language is employed to create the simulator and other control functions of the shop, cell and machine controllers. Such an approach is called SIMCON (Simulation Control) and the main benefit is that there exists a unique opportunity to develop the simulator that is initially used as a simulation tool and, later, as supporting control software in the real situation.

In this research, the selection of tasks to be auctioned is based on "First Come First Auctioned" (FCFA). The bidding function is based on the Earliest Finishing Time (EFT) and the rule used to load a task on a machine is based on FCFS (First Come First Served). Experimental results illustrates the "hybrid" auction-based scheme and verifies the operation of the implemented hybrid control architecture.

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