ABSTRACT

Tool Management in Computer Integrated Manufacturing. (May 1995)

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Traditional models in production planning and scheduling have often overlooked tooling and its perishability. Tools wear and tool life depends on cutting speed, feed, depth of cut, entry and exit angles, etc. Tools get moved through the factory floor from one processing center to another, making tracking and monitoring difficult. Hence, tool management systems which ensure that the right tools are delivered to the right places at the right times through the factory floor are necessary in today's dynamically changing manufacturing environments. The focus of this research will be on the development of an online tool controller that will be an integral part of a shop floor control system (SFCS). The integration of the tool controller with the SFCS ensures that the tooling related activities are included during the planning and scheduling phases of production control. This research describes the functions required of a tool management system in a tool sharing environment and details three specific activities, namely tool selection, tool transport and operational control. These activities are crucial to the efficient performance of an online tool management system. Models and procedures to track the three activities are illustrated. The tool selection activity focuses on the selection of tools for machining operations. A hierarchical decision tree model has been formulated to provide the essence of tool selection. The tool transport activity focuses on moving the desired tool from one processing equipment to another dynamically by minimizing the transport time. A binary integer program has been formulated to determine optimal tool movement. Since,

catastrophic failure of tools is a distinct possibility during a machining operation, the operational control activity focuses on monitoring and updating the life of tools and controlling the risk of catastrophic failure. A mathematical model has been formulated to optimize the cutting conditions so that managerial objectives can be evaluated dynamically, and the operational control of tooling can be executed online. Results of past research indicate that the variations associated with the time to produce a part are large. From the perspective of online control of manufacturing operations, it is necessary to control these variations. In this research, a model has been developed to minimize the variances associated with production time and this model sheds light on the tool selection process.