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An Intelligent Movement Sequence in Production Process for Real Time Robot Control in a Multi-Machine Manufacturing Cell

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Abstract—Material handling robots are routinely used for transferring parts in an interconnected multi-machine cell. The sequence of robot movements between machines is arrived at by the operator, either intuitively or by the use of some form of off-line analysis. It would be extremely beneficial if robots can be provided with additional intelligence to automatically sequence their control programs thereby optimizing production. This paper presents a decision support system that provides a real time control of a robot to meet the stated objective. The developed methodology permits the user to analyze a batch production process by considering a number of parameters that affect the throughput of parts and generates in real-time, the best sequence for a given production. This adds considerable intelligence to a standard robot controller. The parameters currently considered are: sequential versus non-sequential processing of parts; consideration of processing times on machines; the size of buffers in each machine; and the travel time of the robot. A batch production is considered to demonstrate the methodology. To the best of knowledge of the authors, robot controllers have never been provided with this kind of control intelligence. The system developed was tested on a four machine cell serviced by a single robot. The computational time required by the control software is minimal thereby facilitating real-time processing as well as control in a dynamic environment. Robot movements that prioritizes 'unloading of machines first' proved to be superior in comparison to other strategies. The number of buffers beyond a certain limit did not increase the throughput time of the batch. Non-sequential processing reduces throughput time. Loading sequence has a greater impact on sequential processing.

Keywords—Robot control, Decision support system, Flexible manufacturing cell

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