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FMS PERFORMANCE UNDER BALANCING MACHINE WORKLOAD AND MINIMIZING PART MOVEMENT RULES

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Abstract
A simulation model is developed to evaluate the performance of a flexible manufacturing system with respect to time in system. The new rule to assign parts to machine-tools we propose, OOM (Only One Machine), designed to minimize parts movements performs poorer than WINQ (Work In Queue), a rule directed at balancing machine workload. Different numbers of automated guided vehicles (AGV) produce significantly different results with the best performance resulting with five AGVs. Three AGVs are too few to handle the transportation requirements, whereas seven may, to some extent, increase AGV blockage. The number of parts that can be entirely processed on one single machine is found to impact performance, but the impact is not consistent across the experimental conditions. Three rules to sequence parts to be processed are found to have a moderate impact when OOM assignment is employed, but have no impact under the WINQ assignment rule.
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Key Words: Flexible Manufacturing System, OOM, Simulation, Time in System, WINQ

1. INTRODUCTION

Contemporary market requirements drive the manufacturing into developing capabilities to cope with large product variety, low quantity, small batches and on-time delivery. Flexible manufacturing system (FMS) is a manufacturing setting designed to provide responses to those requirements. Time spent to manufacture a part is therefore critical. Planning and scheduling functions need to be addressed with much greater rigor and precision in order to minimize time in system to process a part. FMSs are agile, provide wide flexibility and are well suited for simultaneous production of a wide variety of part types in low volumes [1].

The main purpose of this research is to evaluate the performance of a dedicated FMS with respect to time in system (*T*). Two rules to assign machines to parts, three rules to sequence jobs at a particular machine, three levels of available automated guided vehicles (AGV) and two levels of machine commonality will be tested. In a manner similar to the component commonality concept [2], in this study machine commonality refers to the number of parts that can be entirely processed on one single machine. Parts will be loaded onto a pallet in accordance with the first-come-first-served discipline. Once loaded, there is a need to assign the part to the machine-tool (MT) required to perform the next operation. The assignment decision will be based upon one of the two assignment *(A)* rules: OOM (Only One Machine) and WINQ (Work In Queue). Following the machine assignment decision, parts will be launched into the FMS and scheduled in front of the MT to be processed based upon one of three sequencing *(S)* rules: shortest processing time (SPT), SPT divided by total processing time (SPT/TOT), and most operations per part (MOPP). Because the performance of a FMS has been shown to be related to the configuration and hardware available to move parts around the system, the number *(V)* of AGV will be defined as the third experimental factor and will be set at three different levels of intensity: 3, 5 and 7 AGVs. Finally, the number of

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