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A NEW RELEASE OF MODIFIED DISSIMILARITY MAXIMIZATION METHOD FOR REAL TIME ALTERNATIVE ROUTING SELECTION IN AN FMS

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ABSTRACT: *Routing flexibility is one of among common types of flexibilities that exist in flexible manufacturing systems. It can be found in each system that contains alternative, identical machines or redundant machine tools.*
Modified DMM (Dissimilarity Maximization Method) is one of the most recent proposed heuristics for real time FMS scheduling by considering the routing flexibility. This rule is developed for part routing decisions by using a dissimilarity coefficient used to differ the routings from others in terms of the machines types, in order to reduce the congestion in the system and consequently improving the system throughput.
This work presents an improvement of this method with a new dissimilarity coefficient which takes into account the breakdowns probability in the procedure of selecting a routing for a part.
The simulation experimentation results obtained with presence of breakdowns after several simulations in a typical flexible manufacturing show that for an overloaded system, the new approach improve clearly the system performances in terms the production rate, machines and material handling utilisation rate.

KEYWORDS: *Flexible manufacturing systems, Alternative routing, Routing selection rule, Routing flexibility.*

1 INTRODUCTION

A Flexible Manufacturing System (FMS) is an integrated system composed of automated workstations such as computer numerically controlled (CNC) machines with tool changing capability, a material handling and storage system such as automated guided vehicles or conveyors, and a computer control system which controls the operations of the whole system (MacCarthy and Liu, 1993). It is designed to combine high productivity and production flexibility. But to achieve simultaneously these two goals, a FMS needs an adapted control. One of the most important and difficult problem to solve in order to control a FMS is to propose an efficient schedule for the production planning.

The scheduling problem can be considered as the allocation of a set of tasks to a set of resources under specified constraints (French, 1982; Pinedo, 2008). A job is defined as a set of interrelated tasks.

Over the last three decades, many researchers have extensively investigated the scheduling problems for FMS's. As a result, various types of scheduling problems are solved in different FMS environments, a number of approaches, procedures and varieties of algorithms are employed to obtain optimal or near optimal schedules in these systems. Traditionally, different analytical tools such as mathematical modelling, dynamic programming, branch and bound methods can be employed to obtain the optimal schedule. But according to (Akyol and Araz, 2007) these approaches have been addressed in a static scheduling environment where the system attributes are deterministic. However, most manufacturing systems operate in dynamic environments. For this reason, the schedule developed beforehand may become inefficient in a dynamic environment characterised by uncertain changes of events including in particular machine failures, arrival of urgent jobs…

In these environments, scheduling decisions are to be made in a very short time as the time required to generate a schedule becomes relatively more important factor than merely finding a best quality schedule in an extended period of time. Moreover, schedule is required to be highly reactive to cope with unanticipated circumstances (Shahzad, 2011).

The scheduling problems in dynamic environments are best tackled by a synergy of scheduling algorithms and heuristics. But according to Saygin *et al.* (2001) many of them do not consider the influence of routing flexibility and most of the studies that consider routing flexibility in FMS focus on the problem of routing selection prior to production. To cope with this drawback, they