NC POST-PROCESSOR GENERATOR MODEL FOR OPTIMIZATION OF FMS TECHNOLOGIES

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Abstract: *Engineering machining processes realized in flexible manufacturing systems (FMS) is a highly complex engineering task, especially since it encompasses complex optimization procedures apart from engineering. For a broad array of different workpieces produced in different series it is very difficult to engineer a manufacturing process for attaining maximum processing productivity with minimal production costs. The paper presents a developed post-processor model enabling automatic generating of the NC code for all NC programs executed simultaneously in the production process on a greater number of machining centers. The model engrosses the different variants of tools in a machining center magazine, a different combination of elements of the machining mode, possibility of the most favorable layout of workpieces on palettes, compliance with the technological requirements in terms of simultaneous tool changes in machining center magazines, the required total processing time and minimal production costs. To that aim has been developed the post-processor generator, as a program and software system, enabling all NC programs to be automatically updated based on the set up optimization strategy from tool changes, changes in cutting mode elements and technological operations. Such updated NC programs contain optimal technological parameters and provide minimal costs of production while at the same time the maximum utilization of tools during manufacture at an exactly specified time.*

1. INTRODUCTION

The optimal manufacturing process in a classical production system arises as a result of optimal performing of individual technological operations when developing each workpiece according to multifunctional dependencies between the machine tool, workpiece material, tools and elements of the machining mode. In FMS technological processes this isn't the case, because procedural dependencies are very important in processing alongside the functional. Optimizing the technological process in FMS is based on a much more complex model, because production in FMS has a series of production specifics in a classic production system [1].

The technological task for processing a group of parts (A_1, A_2, A_3, ..., A_n) in FMS is set for the defined and pre-known FMS configuration. Besides, for designing an optimal technological process in FMS we need to have as input data the series that should be produced for every workpiece from the assortment (SA_1, SA_2, SA_3, ...,SA_n, whereby in the general case is SA_1 # SA_2 # SA_3 # ... # SA_n), the total time for processing the entire assortment of parts in a given series (T_z) and the grade (e) of utilization over time of the machining centers.

Part groups that are simultaneously processed in FMS can be comprised of a smaller or lesser number of different parts (A_1, A_2, A_3, ..., A_n), while its series can also be very different. Some workpieces can be made in a smaller number of pieces, while others can be in larger series. All workpieces in a group don't have to be of the same material. All this indicates that the production process in FMS is quite flexible from several aspects and that the engineering procedure and machining optimization in FMS is quite complex [2] .

2. OPTIMIZING FLEXIBLE MACHINING

The optimization of technology [3] starts in a phase when the NC programs for all grippings for a workpiece group that is simultaneously processed in FMS have been done. By analyzing each generated NC program, there are a couple of resulting parameters as statistic indicators of the quality of engineering the machining process (Figure 1):

- The total number of technological operations
- The duration of each operation,
- The total indexing number,
- A list of tool sets by each NC program and a list of elements for each individual set (main holder, extension piece, reducing piece, requisites, cutting tools),
- The total number of tool changes and number of all tools participating in executing the NC program,
- No-traverse period – the period the tools move without cutting the material,
- Cutting time – the period of time in which the tool blades mesh the workpiece material (working traverse rate),
- Total indexing period,
- Total time for tool change and