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An integer programming approach for process planning for mixed-model parts manufacturing on a CNC machining center

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ABSTRACT

The manufacturing system for mixed parts is prevalent in many industries due to the continuous demand of product variety. Thus, the mathematical model to design a process plan is developed by using the integer linear programming. The main aim is to minimize the total production time. The main time factors included in the model composed of the machining time, tool traveling time, tool changing time and tombstone face changing time. The significant design constraints are the precedence operations, fixture design, and available cutting tool constraints. Furthermore, a variation of part styles is also accounted for in this study as the different types of a part can be concurrently mounted and processed which makes this problem unique. Therefore, this problem is much more complex than the normal single model process planning. The model developed using integer programming will determine a sequence of required machining operations. It also decides the face of the machining part to be fastened on the tombstone face. In addition, a suitable cutting tool will be selected based on minimum total production time. The result of this paper, aids in solving process planning difficulty in the dedicated flexible manufacturing system in the era of Industry 4.0.

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