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GA-based adaptive setup planning toward process planning and scheduling integration.

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Summary: Setup planning of a part for more than one available machine is a typical combinatorial optimisation problem under certain constraints. It has significant impact not only on the whole process planning but also on scheduling, as well as on the integration of process planning and scheduling. Targeting the potential adaptability of process plans associated with setups, a cross-machine setup planning approach using genetic algorithms (GA) for machines with different configurations is presented in this paper. First, based on tool accessibility analysis of different machine configurations, partially sequenced machining features can be grouped into certain setups; then by responding to the requirements from a scheduling system, optimal or near-optimal setup plans are selected for certain criteria, such as cost, makespan and/or machine utilisation. GA is adopted for the combinatorial optimisation, which includes gene pool generation based on tool accessibility examination, setup plan encoding and fitness evaluation, and optimal setup plan selection through GA operations. The proposed approach is implemented in a GA toolbox, and tested using a sample part. The results demonstrate that the proposed approach is applicable to machines with varying configurations, and adaptive to different setup requirements from a scheduling system due to machine availability changes. It is expected that this approach can contribute to process planning and scheduling integration when a process plan is combined with setups for alternative machines during adaptive setup planning.

MSC:

90B35 Deterministic scheduling theory in operations research
90C59 Approximation methods and heuristics in mathematical programming

Keywords:

setup planning; genetic algorithms; tool accessibility; process planning and scheduling integration

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