An Assembly Sequence Planning Approach With A Rule-Based Multi-State Gravitational Search Algorithm

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ABSTRACT

Assembly sequence planning (ASP) becomes one of the major challenges in product design and manufacturing. A good assembly sequence leads to reduced costs and duration in the manufacturing process. However, assembly sequence planning is known to be a classical NP-hard combinatorial optimization problem; ASP with many product components becomes more difficult to solve. In this paper, an approach based on a new variant of the gravitational search algorithm (GSA) called the rule-based multi-state gravitational search algorithm (RBMSGSA) is used to solve the assembly sequence planning problem. As in the gravitational search algorithm, the RBMSGSA incorporates Newton's law of gravity, the law of motion, and a rule that makes each assembly component of each individual solution occur once based on precedence constraints; the best feasible sequence of assembly can then be determined. To verify the feasibility and performance of the proposed approach, a case study has been performed and a comparison has been conducted against other three approaches based on simulated annealing (SA), a genetic algorithm (GA), and binary particle swarm optimization (BPSO). The experimental results show that the proposed approach has achieved significant improvement in performance over the other methods studied.

KEYWORKS: Assembly sequence planning; Combinatorial optimization problem; Meta-heuristic; Multi-state gravitational search algorithm

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