A three-stage integrated approach for assembly planning

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Abstract

In practice, assembly planning often consists of assembly sequence generation and assembly modeling. Improper assembly planning not only results in higher product cost and lower productivity but may also increase operational difficulty, maintenance inefficiency and quality loss.

This study develops a three-stage integrated approach with some heuristic working rules to assist the planner to obtain a feasible assembly plan. In the first stage, Above Graph and transforming rule are used to create a correct explosion graph of the assembly models. In the second stage, a three-level relational model, with geometric constraints and assembly precedence diagrams (APDs), is generated to create a complete relational model graph and a near-optimal assembly sequence. In the third stage, the proposed back propagation neural network outperforms in predicting the available assembly sequence due to its parallel structure and fast learning.

A real-world example of electric appliances is utilized to evaluate the feasibility of the proposed model in terms of the difference of assembly sequences generating from assembly precedence diagrams (APDs) and Neural Networks. The results show that the proposed neural-network approach could be easier to obtain a feasible assembly sequence than graph-based approach, and allow the designer to recognize the contact relationship and assembly constraints of three-dimensional (3D) components in a virtual environment type.

Keyword：assembly planning, neural networks, assembly precedence diagrams, penalty matrix