A systematic optimization approach for assembly sequence planning using Taguchi method, DOE, and BPNN

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Abstract

Research in assembly planning can be categorised into three types of approach: graph-based, knowledge-based and artificial intelligence approaches. The main drawbacks of the above approaches are as follows: the first is time-consuming; in the second approach it is difficult to find the optimal solution; and the third approach requires a high computing efficiency. To tackle these problems, this study develops a novel approach integrated with some graph-based heuristic working rules, robust back-propagation neural network (BPNN) engines via Taguchi method and design of experiment (DOE), and a knowledge-based engineering (KBE) system to assist the assembly engineers in promptly predicting a near-optimal assembly sequence. Three real-world examples are dedicated to evaluating the feasibility of the proposed model in terms of the differences in assembly sequences. The results show that the proposed model can efficiently generate BPNN engines, facilitate assembly sequence optimisation and allow the designers to recognise the contact relationships, assembly difficulties and assembly constraints of three-dimensional (3D) components in a virtual environment type.

Keyword：assembly sequence planning; assembly precedence diagrams; neural networks; design of experiment; Taguchi method