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, knowledgebased
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