

Productivity improvement with parallel adjacent U-shaped assembly lines

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ABSTRACT

A novel configuration of assembly lines was proposed in this research, namely parallel adjacent U-shaped assembly lines (PAUL). Typically, in a multiple U-line facility, each U-line is designed to work independently which may cause some workstations were not fully functioned. The PAUL aimed at increasing the utilisation of the whole facility by allowing cross-trained workers to work on the opposite legs of the adjacent U-lines (multi-line workstations). This configuration is easier to implement than parallel U-lines due to no restriction in terms of the lengths of U-lines to be paralleled and hidden expenditures that could be incurred in shop floor reconstruction. Since the line balancing of the PAUL is NP-hard and many conflicting objectives need to be optimised simultaneously, the evolutionary meta-heuristic which was the hybridisation of the multi-objective evolutionary algorithm based on decomposition (MOEA/D) and particle swarm optimisation (PSO), namely MOEA/D-PSO, was developed to effectively solve the problem. In addition, the decoding algorithm to convert the solutions obtained from MOEA/D-PSO into the PAUL's configuration was proposed. The performance of MOEA/D-PSO was evaluated against MOEA/D and multi-objective particle swarm optimisation (MOPSO). The experimental results reveal that MOEA/D-PSO outperformed its rival algorithms under the convergence-related performance.

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