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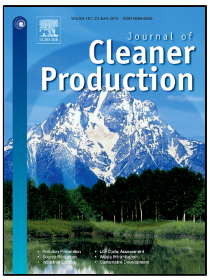

Multi-objective Optimization of Material Delivery for Mixed Model Assembly Lines with energy consideration

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Multi-objective Optimization of Material Delivery for Mixed Model Assembly Lines with energy consideration

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Abstract: Since sustainable scheduling is arousing increasing attention from many manufacturing enterprises and energy consumption is a core problem regarding sustainability, the purpose of this paper is to develop an energy-efficient scheduling method to fulfill material delivery tasks in mixed-model assembly lines. In this research, the objective of minimizing the energy consumption is jointly integrated with the operational criterions when executing material delivery tasks. Owing to the NP-hard nature of the considered problem, a Taboo enhanced Particle Swarm Optimization (TEPSO) algorithm is developed to solve the multi-objective problem. Several improving strategies are applied to enhance the performance of the proposed TEPSO in order to obtain a stronger local search capability and faster search speed. The performance of the proposed TEPSO algorithm is evaluated by comparing with two other high-performing multi-objective optimization methods. Computational experiments are conducted in order to test and verify the effectiveness and efficiency of the proposed TEPSO algorithm. The achievements reported in this paper might be inspiring for further studies on energy-efficient production scheduling.

Key words: Energy efficiency; Multi-objective optimization; Part feeding; Mixed-model assembly line

1 Introduction

With a growing concern over the effect of global warming and environmental issues, energy consumption has become a substantial topic for many manufacturing enterprises. Manufacturing activities in production processes play a main character in industrial energy consumption, responsible for nearly 90% of the total (Salahi et al. (2016)). Reducing the energy consumption in industrial sector has become an area of interest for many academic researchers in recent years (Liu et al. (2014), Zhu et al. (2015)) and improving the energy efficiency has been an attractive topic in many traditional industries such as chemical, steel and automotive industry (Choe et al. (2015)). Moreover, practices on energy waste reduction through energy-aware production scheduling methods are now regarded as one of the top business priorities among many enterprises.

While much advancement has been made through energy-efficient vehicle propulsion, increasing effort has been devoted to the scheduling sector of material handling operations. ‘‘Greening” of material handling scheduling calls for much less cost than developing new material handling equipment or propulsion technologies, since only changes in the software side are involved by this way. Nowadays, it is widely believed that there can be tremendous opportunities in developing novel scheduling techniques for material handling issues to simultaneously include both criterions for operational performance and energy efficiency (Lee et al. (2016)).

In this paper, we propose an energy-efficient part feeding problem (EPFP) by incorporating energy