Thematic issue on “advanced intelligent scheduling algorithms for smart manufacturing systems”

Ling Wang¹ · Guohua Wu² · Liang Gao³

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Manufacturing industry is the material basis of main industrial body and the engine for the rapid growth of economy as well as an important guarantee for overall national power. Production scheduling is one of the most common and significant problems faced by the manufacturing industry, which is to allocate limited resources to tasks over time and to determine the sequence of operations so that the constraints of the manufacturing system are met and the performance criteria are optimized as well. Advanced scheduling theories and technologies play important roles in smart manufacturing systems under Industry 4.0 to improve product adapting ability and competitiveness in the dynamically changing market with the goal of low consumption, clean and flexible production. Due to a variety of complexities in manufacturing systems, intelligent optimization algorithms, such as genetic algorithm, particle swarm optimization, ant colony optimization, differential evolution, estimation of distribution algorithm, artificial bee colony, and especially memetic algorithms, have been successfully applied to the classical scheduling problems and the generalized problems as well as the practical systems.

This thematic issue aims to reflect the state-of-the-art of the advanced intelligent optimization research especially memetic computing that satisfies the needs of smart manufacturing scheduling systems. After a double-blinded peer-review process, seven papers have been accepted and

included in this issue, covering various innovative intelligent optimization techniques for different kinds of complex scheduling problems.

The first paper titled “An improved differential evolution algorithm for solving a distributed assembly flexible job shop scheduling problem” by Wu et al. proposes a multi-objective memetic algorithm by combining differential evolution and simulated annealing to minimize the earliness/tardiness and the total cost for the distributed assembly flexible job shop scheduling problem effectively and efficiently.

The second paper titled “An intelligent scheduling algorithm for complex manufacturing system simulation with frequent synchronizations in a cloud environment” by Yao et al. proposes a performance estimation model based optimization algorithm by incorporating simulated annealing into genetic algorithm to allocate appropriate service instances for complex manufacturing system simulation in a cloud environment.

The third paper titled “Mathematical modeling and a discrete artificial bee colony algorithm for the welding shop scheduling problem” by Li et al. presents the mathematical model and proposes a discrete artificial bee colony algorithm combining the problem-specific destruct and construct operators for the welding shop scheduling. The proposed algorithm can achieve better results than genetic algorithm and grey wolf optimizer.

The fourth paper titled “Project portfolio selection and scheduling under a fuzzy environment” by Zhang et al. proposes a modified multi-objective evolutionary algorithm for the integrated project portfolio selection and scheduling in a fuzzy environment with the consideration of benefit and risk factors simultaneously. Comparative results show that the proposed outperforms the multi-objective optimization evolutionary algorithm/decomposition (MOEA/D) and the non-dominated sorting genetic algorithm II (NSGA-II) with respect to diversity, spread, and convergence.

The fifth paper titled “Multi-objective flow shop scheduling with limited buffers using hybrid self-adaptive differential evolution” by Liang et al. proposes self-adaptive

✉ Ling Wang
wangling@tsinghua.edu.cn

Guohua Wu
guohuawu.nudt@gmail.com

Liang Gao
gaoliang@mail.hust.edu.cn

¹ Department of Automation, Tsinghua University, Beijing, China

² School of Traffic and Transportation Engineering, Central South University, Changsha, China

³ School of Mechanical Science and Engineering, Huazhong University of Science and Technology, Wuhan, China

differential evolution algorithms by combining various local searches to minimize the makespan and the largest job delay simultaneously for the flow shop scheduling with limited buffers. Numerical comparisons are conducted among different hybrid algorithms for different scale of problems.

The sixth paper titled “Estimation of distribution evolution memetic algorithm for the unrelated parallel-machine green scheduling problem” by Xue et al. proposes a memetic algorithm by combining estimation of distribution algorithm (EDA) and neighborhood search operators to minimize the makespan and the total carbon emission for the unrelated parallel-machine green scheduling. Extensive computational tests show that the proposed algorithm outperforms the pure EDA and the NSGA-II.

The last paper titled “Genetic algorithms with greedy strategy for green batch scheduling on non-identical parallel machines” by Tan et al. proposes a single-population genetic algorithm and a multi-population genetic algorithm for the batch scheduling problems on non-identical parallel machines with time-of-use electricity prices. By using the greedy strategy and the self-adaptive parameter adjustment strategy, the proposed genetic algorithms can achieve good performances. Moreover, for the large-scale instances, the multi-population genetic algorithm implemented by parallel computing performs better than the single-population genetic algorithm.

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