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Due date optimization in multi-objective scheduling of flexible job shop production

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A B S T R A C T

The manuscript presents the importance of integrating mathematical methods for the determination of due date optimization parameter for maturity optimization in evolutionary computation (EC) methods in multi-objective flexible job shop scheduling problem (FJSSP). The use of mathematical modelling methods of due date optimization with slack (SLK) for low and total work content (TWK) for medium and high dimensional problems was presented with the integration into the multi-objective heuristic Kalman algorithm (MOHKA). The multi-objective optimization results of makespan, machine utilization and due date scheduling with the MOHKA algorithm were compared with two comparative multi-objective algorithms. The high capability and dominance of the EC method results in scheduling jobs for FJSSP production was demonstrated by comparing the optimization results with the results of scheduling according to conventional priority rules. The obtained results of randomly generated datasets proved the high level of job scheduling importance with respect to the interdependence of the optimization parameters. The ability to apply the presented method to the real-world environment was demonstrated by using a real-world manufacturing system dataset applied in Simio simulation and scheduling software. The optimization results prove the importance of the due date optimization parameter in highly dynamic FJSSP when it comes to achieving low numbers of tardy jobs, short job tardiness and potentially lower tardy jobs costs in relation to short makespan of orders with highly utilized production capacities. The main findings prove that multi-objective optimization of FJSSP planning and scheduling, taking into account the optimization parameter due date, is the key to achieving a financially and timely sustainable production system that is competitive in the global market.

A R T I C L E   I N F O

Keywords:
Flexible job shop scheduling problem (FJSSP);
Due date;
Makespan;
Capacities utilization;
Multi-objective optimization;
Evolutionary computation;
Multi-objective heuristic Kalman algorithm;
Simio simulation and scheduling software

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