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An Energy Consumption Model under Time-Of-Use Rates for Scheduling Of Manufacturing Shops

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One of the most important contributors supporting economic prosperity in Kansas is attributed to manufacturing. It accounted for 16.30% of the output and 11.69% of the workforce (2020 Kansas Manufacturing Facts). In addition, small businesses employed 51% of the private workforce in 2016 (Kansas Small Business Profile, 2019). With such an importance of small businesses within Kansas, this research focuses on small manufacturing shops. Scheduling of manufacturing industries with the aim of minimizing makespan have been studied extensively over the last decades. Recently, green production scheduling considering energy efficiency is emerging as one of the important research areas. To address the critical issues concerning the increased energy consumption and environmental pollution, this research attempts to develop a multi-objective model for manufacturing shops, considering electric consumption cost under time of use (TOU) tariffs, worker's cost, and completion time of all products. Workforces with different performance are considered for machine tools adjustment. A multi-objective genetic algorithm (MOGA) is constructed to minimize not only completion time of all jobs, but also the total electricity costs (TEC) and worker's costs. In order to check the performance of the proposed algorithm, different scheduling test problems are designed and a comprehensive computational experiment is carried out. The results indicate that the proposed MOGA algorithm is able to constructs different optimal scheduling scenarios for manufacturing shops, by which products are completed in a shortest time interval. In addition, total cost including energy consumption and workforces' costs are reduced to a great extent.