

OPTIMIZATION OF PIPE SPOOL FABRICATION SHOP SCHEDULING
USING GENETIC ALGORITHM

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I would like to dedicate this dissertation to my beloved father, Padar Mokhtari Moghadam, who taught me how to be strong and ambitious. It is also dedicated to my beloved mother, Arous Nasiri Rad, who taught me how to be patience and love people kindly.

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ABSTRACT

Spool fabrication shop is an intermediate phase in the piping process for construction projects. The delivery of pipe spools at the right time in order to be installed in the site, is very important. Therefore, effective scheduling and control of the fabrication shop has a direct effect on the productivity and successfulness of the whole construction projects. This research developed a genetic algorithm (GA) in order to generate a feasible and near-optimal schedule for the operational level of pipe spool fabrication shop based on the concepts and methods of job shop scheduling problems. In the proposed algorithm, an improved chromosome representation is used to conveniently represent a schedule for the fabrication shop. Operation-based global selection and Operation-based local selection are designed to generate high-quality initial population in the initialization stage. To adapt to the special chromosome structures and the characteristics of the problem, precedence order-based crossover (POX), two-point crossover, and uniform crossover are used. In addition, different mutation operators for operation sequence part and machine assignment part of the chromosome are used. The data which consist of operations processing time, and dimension of spools and stations are collected from an industrial fabrication shop. The proposed algorithm is applied by using the collected data to obtain a feasible and near-optimal schedule for the operational level of pipe spool fabrication shop. The results showed that the productivity of the fabrication shop by using the proposed algorithm for scheduling fabrication processes has increased to 178 percent.

ABSTRAK

Kedai fabrikasi kili adalah fasa perantaraan dalam proses paip untuk projek-projek pembinaan. Penghantaran kili paip pada masa yang betul untuk dipasang dalam tapak pembinaan adalah sangat penting. Oleh itu, penjadualan dan kawalan berkesan kedai fabrikasi mempunyai kesan langsung ke atas produktiviti dan kejayaan sesuatu projek pembinaan keseluruhan. Kajian ini membangunkan algoritma genetik (GA) untuk menjana jadual yang sesuai dan hampir optimum untuk peringkat operasi kedai fabrikasi paip kili berdasarkan konsep dan kaedah kerja kedai masalah penjadualan. Dalam algoritma yang dicadangkan itu, perwakilan kromosom yang lebih baik digunakan untuk mewakili jadual untuk kedai fabrikasi. Pemilihan global berasaskan Operasi dan Operasi berasaskan pemilihan tempatan berasaskan Operasi direka untuk menjana populasi awal yang berkualiti tinggi di peringkat pengawalan. Untuk menyesuaikan diri dengan struktur kromosom khas dan ciri-ciri masalah, keutamaan crossover berasaskan pesanan (POX), crossover tundamata, dan crossover seragam digunakan. Di samping itu, pengendali mutasi yang berbeza untuk bahagian operasi urutan dan bahagian mesin tugas digunakan. Data yang terdiri daripada masa pemprosesan operasi, dan dimensi kili dan stesen diambil dari sebuah kedai fabrikasi industri. Algoritma yang dicadangkan dilaksanakan dengan menggunakan data yang dikumpul untuk mendapatkan jadual yang sesuai dan hampir optimum untuk peringkat operasi kedai fabrikasi paip kili. Hasil kajian menunjukkan bahawa produktiviti kedai fabrikasi dengan menggunakan algoritma yang dicadangkan bagi penjadualan proses fabrikasi meningkat kepada 178 peratus.