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論文題目	A Hybrid Methodology for Production Rescheduling in Flow Shop Environment		
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論文の内容の要旨

The rescheduling process is indispensable in actual production environments to adapt schedules when significant disturbances render existing ones suboptimal. Manufacturers often face the need to rapidly reschedule production tasks. This research presents a methodology for production rescheduling in flow shop environments with machine failure disturbances, named PPGA-ANN. The primary objective of the methodology is to minimize makespan while ensuring sufficient computational time for rescheduling. Prior to production, the proposed methodology includes a stage of training in which the Perturbation Population Genetic Algorithm (PPGA) is employed to address generated scenarios of flow shop production with machine failure problems. To validate the efficacy of PPGA, its performance is compared to that of other research and the genetic algorithm by using the same data set from a widely used scheduling benchmark. In addition, artificial neural networks (ANNs) are used to store the PPGA-acquired rescheduling knowledge. During the stage of implementing, when a machine failure occurs during production, ANNs provide the rescheduling solution if the machine failure situation matches the generated scenarios. Otherwise, the PPGA, incorporating the initial solution obtained from the ANNs, offers the rescheduling solution. Experimental results consistently demonstrate that PPGA-ANN outperforms benchmark algorithms in terms of makespans, while also providing expedited solutions compared to the genetic algorithm and PPGA used individually. In conclusion, the proposed PPGA-ANN for flexible manufacturing production rescheduling not only exhibits robust

performance in handling machine failures in scheduling problems but also provides faster schedules, addressing the limitations of existing state-of-the-art meta-heuristic algorithms that may have impractical computational times for implementation.

Keywords: production rescheduling, machine failure, flow shop production, genetic algorithm, artificial neural network

論文審査の結果の要旨

In dynamic manufacturing, where unforeseen events can occur at any time, the rescheduling of production systems is crucial decision support that plays a pivotal role in the success of the manufacturing process. The main objective of this dissertation is to develop a hybrid method that combines artificial newral network (ANN) with generic algorithm (GA) for production rescheduling in flow shop environment with machine failure disturbances, aiming to minimize the makespan while ensuring sufficient computational time for efficient production rescheduling. The main contributions are summarized as follows.

This research first proposes a so-called Perturbation Population Genetic Algorithm (PPGA) for determining the optimal solution for each scenario of large-scale flow shop production with machine failure. Then, the optimal solutions for machine failure scenarios obtained from PPGA are used to train an ANN for solving the problem of production rescheduling. To demonstrate its effectiveness, the proposed PPGA-ANN method is experimentally tested using the benchmark data and compared with existing state-of-the-art meta-heuristic algorithms.

This dissertation has made good contributions both theoretically and practically in the problem of production rescheduling in flow shop environments. The research work presented in this dissertation has resulted in one journal paper and one refereed conference paper.

In summary, Ms. SAOPHAN Pakkaporn has completed all the requirements in the doctoral program of the School of Knowledge Science, JAIST and finished the examination on November 01, 2023, all committee members approved awarding her a doctoral degree in Knowledge Science.