Abstract

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