Intelligent manufacturing/production systems

Modeling, algorithms, and optimization

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Editorial

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Intelligent manufacturing/production systems: Modeling, algorithms, and optimization

Real-world manufacturing problems are heavily influenced by various uncertain factors, and in order to improve the efficiency of such systems, different optimization techniques such as artificial intelligent techniques can be used. The main aim of this Special Collection is to provide a platform for researchers in the area of manufacturing to share their ideas for further improvement of existing manufacturing systems and processes. The breadth of the papers included in this Special Collection clearly underlines that intelligent manufacturing is not limited to a narrow number of fields of study, or to a limited set of application domains. It seems fair to state that the domain is increasing in terms of both application areas and methods applied.

The papers in this Special Collection span a multitude of topics. The contributions roughly belong to two categories: decision-making in intelligent systems and intelligent manufacturing processes. From decision-making in intelligent manufacturing systems, we have a number of interesting contributions. Bocewicz et al.[1] address the problem of achieving robust cyclical or periodic flow in manufacturing. Through novel methods, they develop an approach that allows for the design of a cyclical production schedule where it is possible to take corrective measures in case of disruption. This allows the flow of a still cyclical in nature. These methods are highly relevant for manufacturing systems with fixed takt times. Gu et al.[2] propose a genetic algorithm–based approach to decide on the allocation of car repair stores to ensure the proper allocation of these compared to expected utilization. The approach is a good illustration of the need to apply meta-heuristics to large-scale NP-hard decision problems. Han et al.[3] propose a special framework for dealing with the large-scale problem of scheduling projects in shipyards. The research is a good example of how large-scale decision problems require specialized multi-layered decision logics, which in this case is further improved upon through allowing parallel processing of the computations in the final decision layer. Han et al.[4] consider the problem of offshore project scheduling and propose a two-stage multi-agent approach to address this. To facilitate the solution, two different kinds of algorithms have been designed and implemented. The research is like Han et al.,[3] a good example of the complexity faced in scheduling large projects and potential solutions to these issues. Jiang et al.[5] propose a method for resource and task matching in cyber-physical production systems, where the challenge is the nature of the tasks compared to the capabilities of the manufacturing resources. The methods are based on Petri-nets and neural networks and provide a reliable approach to solve this issue. Yang et al.[6] address negotiation issues in manufacturing supply chains. To solve the issues found here, the authors propose a multi-agent approach and suggest this as a fast, flexible, and efficient approach for dealing with negotiations in manufacturing supply chains. Yang et al.[7] also apply a multi-agent approach with a focus on the problem of negotiating in supply chains providing personalized products. Supply chains of this nature are typically highly complex and changing over time. This makes the proposed multi-agent approach a good example of how to address this type of challenge.

In the second category, intelligent manufacturing systems, Chang et al.[8] design an algorithm using machine learning to support fault detection in camera lens production. The proposed approach demonstrates the strength of applying machine learning to standardized processes, such as quality control. Ozoegwu[9] addresses the problem of chatter in process of milling. The research provides a novel method for reducing this through better approximation of the process itself and thus better ability to control the process. Wang and Li[10] propose a combined simulated annealing and artificial neural network approach to improve on placement in semi-conductor manufacturing. The method is demonstrated to have an improved performance over current state. It also serves as a good example of how hybrid optimization methods are increasingly useful in improving the performance of manufacturing processes.

It is with great pleasure that we present this collection of high-quality publications focusing on these challenges. The diversity of issues addressed and methods

employed clearly shows that this is a very fertile area of research.

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