Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA
Published: February 18, 2025

DOI: 10.46254/AN15.20250064

Digital Twin-based Order Acceptance and Scheduling Optimization Considering Outsourcing Options and Lead Time

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Abstract

When the business department of an enterprise decides which orders to accept, they must consider the capacity of both local and outsourced factories to develop a comprehensive plan. However, there is a lack of literature that simultaneously considers order selection scheduling and outsourcing options. This study proposes a simulation optimization model that addresses order selection by considering both local factory scheduling constraints and lead time constraints of outsourced factories. The model determines which orders to outsource for specific processes and provides a production schedule for the local factory. Additionally, this paper introduces a Digital Twin-based framework, where the simulation system interacts with actual production information to update the probability distributions of simulation times and outsourcing orders. This enables the simulation to increasingly reflect the real production situation. Finally, numerical analysis is conducted to discuss the relationships between various parameter settings. The more stable the capacity and delivery times of the satellite factories, the higher the outsourcing costs for the local factory. The study aims to explore the trade-offs between the lead time variability of outsourced processes and outsourcing costs. The contributions of this paper are as follows: 1.Establishing a simulation optimization model to determine order acceptance, outsourcing, and scheduling. 2.Proposing a DT-based framework that continuously updates scheduling simulation information. 3.Simulating the impact of different variabilities on makespan and profit through the lead time of processes returning to the local factory and exploring the trade-offs involved.

Keywords
Hybrid Flow Shop Scheduling, Outsourcing, Order Acceptance, Lead Time