

# Assembly transport optimization for a reconfigurable flow shop based on a discrete event simulation

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## ABSTRACT

Reconfigurable Manufacturing Systems (RMSs) are widely used to produce small batches of customized products in the current manufacturing environment. We comprehensively optimized the assembly transport strategy, production process, and production configuration of a reconfigurable flow shop (RFS). Firstly, three assembly transfer strategies, one-to-one, one-to-many, and many-to-many, are proposed for an RFS, given the specific process limitations. In addition, a production simulation model of the RFS is established by the Plant Simulation software to verify and compare those three strategies with realistic production constraints considered. Moreover, the production processes are optimized, and the optimal buffer configuration and vehicle configuration are optimized by the design of experiment (DOE) method. After the optimization processes, the throughput and facility utilization under each strategy increases significantly. Additionally, the optimal buffer size and vehicle quantity under each strategy are determined and compared. The one-to-one strategy can maximize the production output, but it requires the most production resources. In addition, the many-to-many strategy is more efficient than the one-to-many strategy. Our study provides a variety of assembly transport strategies for an RFS and offers an efficient optimization method for production performance and production configuration.

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# Optimizacija transporta pri montaži znotraj rekonfigurabilne proizvodne linije na podlagi simulacije diskretnih dogodkov

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## POVZETEK

Rekonfigurabilni proizvodni sistemi (RMS) se pogosto uporabljajo za izdelavo majhnih serij prilagojenih izdelkov v trenutnem proizvodnem okolju. Izčrpno smo optimizirali transportno strategijo pri montaži, proizvodni proces in proizvodno konfiguracijo velike rekonfigurabilne proizvodne linije (RFS). Najprej so za RFS predlagane tri strategije prenosa sklopov, ena-na-ena, ena-na-mnogo in mnogo-na-mnogo, glede na posebne omejitve postopka. V programski opremi *Plant simulation* smo vzpostavili simulacijski model RFS za preverjanje in primerjavo teh treh strategij z upoštevanimi realnimi proizvodnimi omejitvami. Poleg tega smo proizvodne procese optimizirani, optimalna konfiguracija zalogovnika in konfiguracija vozila pa sta bili optimizirani z metodo zasnovane eksperimenta (DOE). Po optimizaciji sta se pretočnost in izkoriščenost objekta pri vsaki strategiji znatno povečata. Poleg tega smo določili in primerjali optimalno velikost zalogovnika in število vozil za vsako strategijo. Strategija ena-na-ena lahko poveča proizvodnjo, vendar zahteva največ proizvodnih virov. Poleg tega je strategija mnogo-na-mnogo učinkovitejša od strategije ena-na-mnogo. Naša študija je obravnavala različne strategije transporta pri montaži za RFS in ponudila učinkovito optimizacijsko metodo za povečanje zmogljivosti in izboljšanje konfiguracije proizvodnje.

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## PODATKI O ČLANKU

### *Ključne besede:*

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Simulacija diskretnih dogodkov;  
Strategija transporta pri montaži;  
Optimizacija;  
Plant simulation;  
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