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Simulation framework for determining the order and size of the product batches in the flow shop: A case study

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ABSTRACT

The problems of determining the order and size of the product batches in the flow shop with multiple processors (FSMP) and sequence-dependent setup times are among the most difficult manufacturing planning tasks. In today's environment, where necessity for survival in the market is to deliver the goods in time, it is crucial to optimize production plans. Inspired by real sector manufacturing system, this paper demonstrates the discrete event simulation (DES) supported by the genetic algorithm (GA) optimization tool. The main aim is to develop the simulation framework as a support for the daily planning of manufacturing with emphasis on determining the size and entry order of the product batches within specific requirements. Procedures are developed within the genetic algorithm, which are implemented in Tecnomatix Plant Simulation software package. A genetic algorithm was used to optimize mean flow time (MFT) and total setup time (TST) performance measures. Primary constraint for on-time delivery was imposed on the model. The research results show that solutions are industrially applicable and provide accurate information on the batch size of the defined products, as well as a detailed schedule and timing of entry into the observed system. Display of the solution, in a simple and concise manner, serves as a tool for manufacturing operations planning.

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Izvirni znanstveni članek

Simulacijski okvir za določanje vrstnega reda in velikosti serij izdelkov v veliki proizvodnji: Študija primera

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POVZETEK

Težave z določanjem vrstnega reda in velikosti serij izdelkov v veliki proizvodnji z več postajami (FSMP) in zaporednimi časi nastavitve so med najtežjimi nalogami načrtovanja proizvodnje. V današnjem okolju, kjer je preživetje na trgu odvisno od pravočasne dobave blaga, je ključnega pomena optimizacija proizvodnih načrtov. Ta članek je navdihnjen s proizvodnim sistemom iz realnega sektorja in prikazuje diskretno simulacijo dogodkov (DES), ki jo podpira orodje za optimizacijo z genetskim algoritmom (GA). Glavni cilj je razviti simulacijski okvir kot podporo vsakodnevnemu načrtovanju proizvodnje s poudarkom na določitvi velikosti in vrstnega reda izdelave serije izdelkov v okviru posebnih zahtev. Postopki so razviti znotraj genetskega algoritma in se izvajajo v programskem paketu Tecnomatix Plant Simulation. Za optimizacijo meritev uspešnosti povprečnega časa pretoka (MFT) in skupnega časa nastavitve (TST) smo uporabili genetski algoritem. V model je bila vključena primarna omejitev pravočasne dostave. Rezultati raziskave kažejo, da so rešitve industrijsko uporabne in dajejo natančne informacije o velikosti serije opredeljenih izdelkov ter podroben urnik in čas vstopa v opazovani sistem. Prikaz rešitve na preprost in jedrnat način služi kot orodje za načrtovanje proizvodnih operacij.

PODATKI O ČLANKU

Ključne besede:
Načrtovanje procesov;
Velika proizvodnja;
Zaporedni čas nastavitve;
Načrtovanje serij;
Diskretna simulacija dogodkov;
Genetski algoritem (GA)

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