Decentralized optimization of the flexible production lines

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ABSTRACT

The shortening of the production cycle and increasing impact of the technological innovations evokes improvement of the methods used in the production line scheduling. The aim of the presented research is a proposal of the decision model that enables a flexible reaction to the changing production conditions. The central decisions are substituted by the decisions performed on the independent machines level. The machines utilize rather restricted information on the capacities utilization of their technological neighbours. The decisions follow the decision tables (decision chromosomes) re-coded in the course of the evolution. The Genetic algorithms standing behind the model, enable identification of the highly acceptable solutions that is proved by a set of the simulation experiments. The set of independent machines becomes self-organized, having a significant positive effect on the production line capacities utilization. The decentralization aspect makes our proposal somewhat different from other research in the field. The philosophy is built on the fact that each machine makes its production decision based on the available information, which it has at its disposal in a given time. The machine flexible reacts to its neighbours' capacity utilization (machine before and after given production machine) in the production process flow.

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Decentralizirana optimizacija fleksibilnih proizvodnih linij

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POVZETEK

Skrajšanje proizvodnega cikla in vse večji vpliv tehnoloških inovacij povzročata izboljšanje metod, ki se uporabljajo pri terminiranju proizvodne linije. Cilj predstavljene raziskave je predlagati odločitveni model, ki omogoča fleksibilen odziv na spreminjajoče se proizvodne razmere. Osrednje odločitve so nadomeščene z odločitvami, ki se izvajajo na ravni neodvisnih strojev. Stroji uporabljajo precej omejene informacije o izkoriščenosti zmogljivosti svojih tehnoloških sosedov. Odločitve sledijo odločitvenim tabelam (odločitveni kromosomi), ki so bile na novo kodirane v teku evolucije. Genetski algoritem, ki stoji za modelom, omogoča identifikacijo zelo sprejemljivih rešitev, kar dokazuje niz simulacijskih poskusov. Skupina neodvisnih strojev se samoorganizira, kar pomembno pozitivno vpliva na izkoriščenost zmogljivosti proizvodne linije. Zaradi vidika decentralizacije se naš predlog nekoliko razlikuje od drugih raziskav na tem področju. Filozofija je zgrajena na tem, da vsak stroj svojo proizvodno odločitev sprejme na podlagi razpoložljivih informacij, s katerimi razpolaga v danem času. Stroj se prilagodljivo odziva na izkoriščenost zmogljivosti svojih sosedov (stroj pred in po danem proizvodnem stroju) med proizvodnim procesom.

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Decentralizirana optimizacija;
Načrtovanje proizvodnje;
Pravilo najkrajšega časa obdelave;
Samoorganizacija;
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Odločitvena tabela

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