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Functional objectives decision-making of discrete manufacturing system based on integrated ant colony optimization and particle swarm optimization approach

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ABSTRACT

In order to obtain a decision model with universality, the manufacturing unit was regarded as the most basic carrier for the functional objectives of the manufacturing system. This paper has established the functional objective decision model of discrete manufacturing system by characterizing the manufacturing objectives of cost, efficiency, quality, time, agility and greenness, and has introduced the concept of coordination degree between manufacturing units. In weight calculation, the model could balance the importance of the functional objectives required by the customer and the producer. Moreover, according to the NP-hard characteristics of the model, ant colony algorithm and particle swarm optimization (ACO-PSO) algorithm was designed to solve the problem. The feasibility and validity of the algorithm were verified by simulation examples, which could promise the experimental results more satisfactory than the traditional genetic algorithm. In addition, the model can provide more choices for decision-making of functional objectives in discrete manufacturing systems by adjusting the fitness value.

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Izvirni znanstveni članek

Odločanje o funkcionalnih kriterijih za diskretne proizvodne sisteme na podlagi pristopa integracije optimizacije s kolonijo mravelj in optimizacije z rojem delcev

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POVZETEK

Da bi pridobili splošni odločitveni model, se je proizvodna enota obravnavala kot najbolj osnovni nosilec funkcionalnih kriterijev proizvodnega sistema. V članku je opisana vzpostavitev odločitvenega modela diskretnega proizvodnega sistema s funkcionalnimi kriteriji na podlagi opisa proizvodnih kriterijev kot so stroški, učinkovitost, kakovost, čas, okretnost in prijaznost do okolja. V model je vpeljan koncept stopnje usklajevanja med proizvodnimi enotami. Pri izračunu uteži lahko model uravnovesi pomembnost funkcionalnih kriterijev, kot jih zahtevata stranka in proizvajalec. Zaradi računske zahtevnosti je bil za reševanje problema zasnovan optimizacijski algoritem s kolonijo mravelj in z rojem delcev (ACO-PSO). Izvedljivost in pravilnost algoritma sta bili preverjeni s simulacijskimi primeri, ki bi lahko zagotovili, da bodo eksperimentalni rezultati bolj zadovoljivi kot rezultati pridobljeni s tradicionalnim genetskim algoritmom. S prilagoditvijo ciljne funkcije model dopušča tudi več možnosti za odločanje o funkcionalnih kriterijih v diskretnih proizvodnih sistemih.

PODATKI O ČLANKU

Ključne besede:
Diskretna proizvodnja;
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Odločanje;
Optimizacija s kolonijo mravelj (ACO);
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