APEM journal
Advances in Production Engineering & Management
Volume 11 | Number 2 | June 2016 | pp 77–92
http://dx.doi.org/10.14743/apem2016.2.211
ISSN 1854-6250
Journal home: apem-journal.org
Original scientific paper

A simulation approach to the process planning problem using a modified particle swarm optimization

Wang, J.F.[a,*], **Kang, W.L.**[a], **Zhao, J.L.**[a], **Chu, K.Y.**[a]

[a]Department of Mechanical Engineering, North China Electric Power University, Baoding, China

ABSTRACT

Due to the complexity and variety of practical manufacturing conditions, computer-aided process planning (CAPP) systems have become increasingly important in the modern production system. In CAPP, the process planning (PP) problem involves two tasks: operation determining and operation sequencing. To optimize the process plans generated from complex parts, the traditional particle swarm optimization (PSO) algorithm is modified. Efficient encoding and decoding population initialization methods have been developed to adapt the PP problem for the PSO approach. In addition, to avoid the proposed approach becoming trapped in local convergences and achieving local optimal solutions, parameters are set to control the iterations. Several extended operators for the different parts of the particles have been incorporated into the traditional PSO. Simulation experiments have been run to evaluate and verify the effectiveness of the modified PSO approach. The simulation results indicate that the PP problem can be more effectively solved by the proposed PSO approach than other approaches.

ARTICLE INFO

Keywords:
Process planning
Operation determining
Operation sequencing
Particle swarm optimization
Extended operator

**Corresponding author:*
wjf266@163.com
(Wang, J.F.)

Article history:
Received 29 January 2016
Revised 27 March 2016
Accepted 10 May 2016

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APEM journal

Advances in Production Engineering & Management
Letnik 11 | Številka 2 | Junij 2016 | pp 77–92
http://dx.doi.org/10.14743/apem2016.2.211

ISSN 1854-6250
Spletna stran: apem-journal.org
Izvirni znanstveni članek

Simulacijski pristop za reševanje načrtovanja procesov z uporabo modificiranega algoritma rojev delcev

Wang, J.F.[a,*], **Kang, W.L.**[a], **Zhao, J.L.**[a], **Chu, K.Y.**[a]

[a]Department of Mechanical Engineering, North China Electric Power University, Baoding, China

POVZETEK

Zaradi zapletenosti in raznolikosti realnih proizvodnih pogojev so računalniško podprti sistemi za načrtovanje procesov (angl. CAPP) postali v sodobni proizvodnji zelo pomembni. Načrtovanje procesov vključuje dve opravili, in sicer določitev operacij in vrstni red njihovega izvajanja. V delu smo za optimizacijo proizvodnih navodil, pridobljenih iz zapletenih kosov, modificirali tradicionalni algoritem rojev delcev (angl. PSO). Vpeljali smo učinkovito kodiranje in dekodiranje populacije rešitev in tako dosegli prilagoditev problema načrtovanja procesov postopku PSO. Da bi se izognili zdrsom v lokalne optimalne rešitve smo ustrezno nastavili tudi parametre za nadzor iteracij. V običajni PSO algoritem smo vključili tudi dodatne operatorje. Da bi potrdili učinkovitost predlaganega pristopa smo izvedli več simulacijskih eksperimentov. Rezultati so pokazali, da predlagan pristop omogoča učinkovitejše reševanje problemov načrtovanja procesov kot preostali postopki.

PODATKI O ČLANKU

Ključne besede:
Načrtovanje procesov
Določitev operacij
Vrstni red operacij
Optimizacija z rojem delcev
Dodatni operatorji

**Kontaktna oseba:*
wjf266@163.com
(Wang, J.F.)

Zgodovina članka:
Prejet 29. januarja 2016
Popravljen 27. marca 2016
Sprejet 1. maja 2016