

Dynamic integration of process planning and scheduling using a discrete particle swarm optimization algorithm

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ABSTRACT

Because of the inherent relationship between process planning and scheduling, integration of process planning and scheduling (IPPS) provides a new path for further improvements of these two activities. Therefore, a novel two-phase IPPS approach is put forward in this paper. In the new method, the preplanning phase generates a process network for each job with consideration of the static shop floor status. After that, the final planning phase simultaneously creates the process plan of each job and the scheduling plan according to the current shop floor status. Based on the modified definition of IPPS and the proposed mathematical model, the IPPS problem and the dynamic IPPS problem can be solved together. Furthermore, a discrete particle swarm optimization (DPSO) algorithm is proposed to solve the IPPS optimization problem. In the DPSO algorithm, the particles update their positions by crossing with their own historical best positions (pbests) and the global best position of the population (gbest). In order to avoid local convergence, an external archive is introduced to keep more than one elite, and the gbest of each particle is randomly selected from the external archive. Furthermore, mutation operation is introduced to enhance the local search ability of DPSO algorithm. Finally, some comparative results are given to verify the efficiency and effectiveness of the proposed IPPS method and the DPSO algorithm as well as the dynamic IPPS method.

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Dinamična integracija načrtovanja in terminiranja procesa z uporabo diskretnega optimizacijskega algoritma roja delcev

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POVZETEK

Zaradi neločljive povezave med načrtovanjem in terminiranjem procesov je povezovanje načrtovanja in terminiranja procesov (IPPS) ena izmed poti za izboljšavo teh dveh dejavnosti. Zato v tem prispevku predstavljamo nov dvostopenjski pristop IPPS. Pri predlagani metodi se v prvi fazi načrtovanja, ob upoštevanju statičnega stanja v proizvodnji, ustvari procesna mreža za vsako opravilo. Nato se v končni fazi načrtovanja hkrati ustvari procesni načrt vsakega delovnega poteka in načrt razporeditve del glede na trenutno stanje proizvodnje. Na podlagi spremenjene definicije IPPS in predlaganega matematičnega modela lahko problem IPPS in dinamični problem IPPS rešimo skupaj. Poleg tega je predlagan diskretni algoritem za optimizacijo z rojem delcev (DPSO) za reševanje problema optimizacije IPPS. V algoritmu DPSO delci posodablajo svoje položaje tako, da križajo svoje lastne zgodovinsko najboljše položaje in najboljši položaj celotne populacije (gbest). Da bi preprečili lokalno konvergenco, smo uvedli zunanjo arhivsko bazo, ki hrani več kot eno elito, gbest vsakega delca pa se naključno izbere iz te baze. Poleg tega smo vpeljali operator mutacije, s čimer se poveča lokalna možnost iskanja algoritma DPSO. Na koncu smo podali nekatere primerjalne rezultate za preverjanje učinkovitosti in uspešnosti predlagane metode IPPS in algoritma DPSO ter dinamične metode IPPS.

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PODATKI O ČLANKU

Ključne besede:

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