A multi-objective selective maintenance optimization method for series-parallel systems using NSGA-III and NSGA-II evolutionary algorithms

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ABSTRACT

Aiming at the problem that the downtime is simply assumed to be constant and the limited resources are not considered in the current selective maintenance of the series-parallel system, a three-objective selective maintenance model for the series-parallel system is established to minimize the maintenance cost, maximize the probability of completing the next task and minimize the downtime. The maintenance decision-making model and personnel allocation model are combined to make decisions on the optimal length of each equipment's rest period, the equipment to be maintained during the rest period and the maintenance level. For the multi-objective model established, the NSGA-III algorithm is designed to solve the model. Comparing with the NSGA-II algorithm that only considers the first two objectives, it is verified that the designed multi-objective model can effectively reduce the downtime of the system.

ARTICLE INFO

Keywords:
Maintenance;
Series-parallel system;
Maintenance decision model;
Multi-objective optimization;
Selective maintenance;
Evolutionary algorithms;
Non-dominated sorting genetic algorithm;
NSGA-II;
NSGA-III

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Article history:
Received 1 July 2021
Revised 22 October 2021
Accepted 25 October 2021

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Metoda večkriterijske optimizacije selektivnega vzdrževanja za zaporedno vzporedne sisteme z uporabo evolucijskih algoritmov NSGA-III in NSGA-II

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POVZETEK

Trenutno se pri selektivnem vzdrževanju zaporedno vzporednih sistemov domneva, da so časi nedelovanja sistema konstantni in se omejeni viri ne upoštevajo. Da bi rešili ta problem, je predlagan model selektivnega vzdrževanja s tremi cilji: zmanjšanje stroškov vzdrževanja, povečanje verjetnosti dokončanja naslednje naloge in skrajšanje časa nedelovanja. Model odločanja o vzdrževanju in model razporeditve osebja sta združena za sprejemanje odločitev o optimalni dolžini neuporabe vsake opreme, o opremi, ki jo je treba vzdrževati v času neuporabe in o ravni vzdrževanja. Za reševanje postavljene večkriterijskega modela je uporabljen algoritem NSGA-III. V primerjavi z algoritmom NSGA-II, ki upošteva le prva dva cilja, smo ugotovili, da lahko postavljen večkriterijski model učinkovito zmanjša čas nedelovanja sistema.

PODATKI O ČLANKU

Ključne besede:

Vzdrževanje;
Zaporedno vzporedni sistem;
Model odločanja o vzdrževanju;
Večkriterijska optimizacija;
Selektivno vzdrževanje;
Evolucijski algoritmi;
Genetski algoritem za nedominirano sortiranje;
NSGA-II;
NSGA-III

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Zgodovina članka:

Prejet 1. julija 2021
Popravljen 22. oktobra 2021
Sprejet 25. oktobra 2021

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