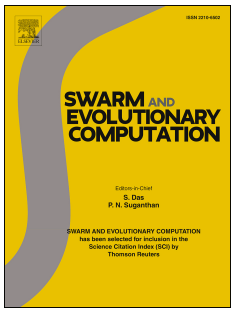
Accepted Manuscript



Multi-objective evolutionary simulation based optimization mechanism for a novel stochastic reliability centered maintenance problem

Seyed Habib A. Rahmati, Abbas Ahmadi, Behrooz Karimi

PII: S2210-6502(17)30363-2

DOI: 10.1016/j.swevo.2018.02.010

Reference: SWEVO 363

To appear in: *Swarm and Evolutionary Computation BASE DATA*

Received Date: 16 May 2017

Revised Date: 22 January 2018

Accepted Date: 7 February 2018

Please cite this article as: S.H.A. Rahmati, A. Ahmadi, B. Karimi, Multi-objective evolutionary simulation based optimization mechanism for a novel stochastic reliability centered maintenance problem, *Swarm and Evolutionary Computation BASE DATA* (2018), doi: 10.1016/j.swevo.2018.02.010.

Multi-objective Evolutionary Simulation Based Optimization Mechanism for a Novel Stochastic Reliability Centered Maintenance Problem

Seyed Habib A. Rahmati[a,b], Abbas Ahmadi[*a], Behrooz Karimi[a]

[a]*Department of Industrial Engineering and Management Systems, Amirkabir University of Technology, Tehran, Iran*

[b] *Department of Industrial Engineering, Faculty of Industrial and Mechanical Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran*

Abstract

This research develops a novel stochastic reliability-centered maintenance (RCM) mechanism within a new multi-objective joint maintenance and production planning problem. RCM in this integrated problem is an agent that monitors and manages the maintenance functions of a stochastic complex production-planning problem, namely flexible job shop scheduling problem (FJSP). The novel developed RCM takes benefit of stochastic condition based maintenance (CBM) approach that works based on stochastic shocking scheme of machines during their process time. It activates the maintenance activities, including preventive and corrective maintenance, according to the degradation level of system reliability after shocks and not merely according to the predetermined intervals. In addition to the maintenance activation times, the maintenance durations of different kinds are also modeled stochastically. Furthermore, different types of stochastic maintenance costs are also considered alongside system reliability and complementation time (C_{max}). Moreover, as the problem belongs to the NP-Hard class of optimization problems, four multi-objective simulation based optimization (SBO) algorithms, called multi-objective biogeography based optimization (MOBBO) algorithm, Pareto envelope-based selection algorithm (PESA), new version of non-dominated sorting genetic algorithm (NSGAIII) and multi-objective evolutionary algorithm based on decomposition (MOEAD) are employed to solve the underlying problem. A novel visualization approach joint by Gant chart is also proposed to discuss the whole RCM scheme, systematically. Different test problems, statistical tests and outputs explain the problem and algorithms' performance explicitly.

Keywords

Reliability-centered maintenance (RCM), stochastic production model, condition-based maintenance (CBM), shocking mechanism, multi-objective simulation-based optimization (SBO), multi-objective evolutionary algorithms.

1- Introduction and literature review

Nowadays, planning production and maintenance activities simultaneously and integrally are inevitable. Maintenance activities affect major terms of production management such as reliability, unavailability or cost. To give just a simple example, inefficient maintenance program can increase costs up to one third due to unnecessary or improper maintenance activities [1]. Moreover, recent emerging technologies such as radio frequency identification (RFID), various sensors, micro-electro-mechanical system (MEMS), wireless Tele-communication, supervisory control and data acquisition (SCADA), and product embedded information devices (PEID) [2] empower production managers to monitor and control their maintenance