APEM journal

**Advances in Production Engineering & Management**
Volume 11 | Number 1 | March 2016 | pp 38–48
http://dx.doi.org/10.14743/apem2016.1.208

**ISSN 1854-6250**
Journal home: apem-journal.org
Original scientific paper

# A bi-objective inspection policy optimization model for finite-life repairable systems using a genetic algorithm

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**ABSTRACT**

This paper presents a bi-objective optimization model for finding the optimal number and optimal aperiodic times for the inspections of finite-life repairable systems when the availability of the component and the total maintenance cost are under consideration. The model utilizes the delay-time concept under perfect inspection assumption. The defect arrival process is modelled using the nonhomogeneous Poisson process and the failure times are probabilistic. The solution to this problem is NP-hard, therefore, a mutation-based genetic algorithm has been designed to solve the model. The effectiveness of the model was demonstrated using seven illustrative examples and compared to an existing classical periodic inspection model that uses a fixed number of inspections. The results showed that the proposed model did better (in all of the attributes) than the aperiodic model that using a fixed number of inspections. Furthermore, the results showed that the proposed model gave better results than a single-objective aperiodic model. The proposed model is a general model that can be implemented with different rates of occurrence of defects and different delay-time distributions. Also this model can be extended easily to cover complex systems and imperfect inspection cases.



**ARTICLE INFO**

*Keywords:*
Maintenance
Aperiodic inspection
Periodic inspection
Delay-time
Multi-objective optimization
Genetic algorithms

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*Article history:*
Received 14 September 2015
Revised 29 September 2015
Accepted 19 October 2015

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APEM journal

**Advances in Production Engineering & Management**
Letnik 11 | Številka 1 | Marec 2016 | Strani 38–48
http://dx.doi.org/10.14743/apem2016.1.208

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

# Dvokriterijski model nadzorne strategije za optimizacijo vzdrževanja popravljivih izdelkov z uporabo genetskega algoritma

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**POVZETEK**

V članku je predstavljen dvokriterijski optimizacijski model za iskanje optimalnega števila in časa neperiodičnih pregledov za inšpekcijo popravljivih sistemov oziroma izdelkov. V ozir so vzeti razpoložljivost sistema oziroma komponente ter skupni stroški vzdrževanja. Model izkorišča koncept časa zastoja ob idealnih inšpekcijskih predpostavkah. Pojavljanje okvar je modelirano z uporabo nehomogenega Poissonovega procesa, časi nedelovanja pa se ravnajo po verjetnostnih načelih. Ker gre za t.i. NP-težki problem, je bil zasnovan genetski algoritem, ki temelji na operaciji mutacije. Učinkovitost modela je predstavljena s pomočjo sedmih zgledov, narejena pa je tudi primerjava z obstoječim klasičnim modelom periodičnih pregledov, ki vključuje konstantno število pregledov. Rezultati so pokazali, da je predlagan model (po vseh lastnostih) boljši kot aperiodični model, ki vključuje konstantno število pregledov, poleg tega pa predlagan model daje boljše rezultate kot enokriterijski aperiodični model. Predlagan model je splošen in se lahko uporabi z različnimi stopnjami pojavljanja napak in različnimi porazdelitvami časov zastojev. Model se lahko na preprost način razširi, da omogoča reševanje problemov pri kompleksnih sistemih in pri neidealnih inšpekcijskih primerih.



**PODATKI O ČLANKU**

*Ključne besede:*
Vzdrževanje
Neperiodično spremljanje
Periodično spremljanje
Čas zastoja
Večkriterijska optimizacija
Genetski algoritmi

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*Zgodovina članka:*
Prejet 14. septembra 2015
Popravljen 29. septembra 2015
Sprejet 19. oktobra 2015