

An uncertain programming model for preventive maintenance scheduling

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Preventive
maintenance
scheduling

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Abstract

Purpose – The purpose of this paper is to illustrate an uncertain programming model for scheduling of preventive maintenance (PM) actions. The PM scheduling, in which PM actions are performed under fixed intervals, is solved by grey systems theory.

Design/methodology/approach – The paper applied the grey evaluation method based on triangular whitening weight functions which includes two classes: endpoint evaluation method and center-point evaluation method.

Findings – Two methods give the same results based on endpoint and center-point triangular whitening weight functions. For validation, the results were compared by Cassady's method.

Originality/value – The scheduling of PM is crucial in reliability and maintenance engineering. Hundreds of parts compose complex machines that require replacement and/or repairing. It is helpful to reduce the outage loss on frequent repair/replacement parts and avoid lack of maintenance of the equipment by controlling the equipment maintenance frequency.

Keywords Uncertainty, Failure, Grey systems theory, Preventive maintenance scheduling

Paper type Research paper

Nomenclature

β	Weibull shape parameter for probability distribution of T	$N(r)$	number of machine failures in r time units of machine operation
η	Weibull scale parameter for probability distribution of T	$x(t)$	hazard function of T
r	PM interval for the machine	t_r	time required to repair the machine
$A(r)$	steady-state machine availability	t_p	time required to perform PM on the machine
$w(r) = E\{N(r)\}$			

1. Introduction

Timely and cost-effective production is becoming increasingly important in today's global competitive markets. For the manufacturers, it is vital to optimize the machine resource utilization by ensuring an efficient and stabilized schedule at the operational level. Traditional literatures on scheduling assume that machines are available at all times. However, in many realistic situations, machines may be unavailable during the scheduling horizon for different reasons, such as breakdowns and scheduled maintenances in typical industrial settings. This availability consideration adds complexity to any scheduling problem, even in a single machine environment (Lu *et al.*, 2015).

In a long-term scheduling, production system is always subject to deterioration with usage, which will affect the availability of machines and the stability of the system.



Uncertain Programming

Padhraic Smyth



Uncertain Programming:

Theory and Practice of Uncertain Programming Baoding Liu, 2013-04-17 Real life decisions are usually made in the state of uncertainty randomness fuzziness roughness etc How do we model optimization problems in uncertain environments How do we solve these models In order to answer these questions this book provides a self contained comprehensive and up to date presentation of uncertain programming theory It includes numerous modeling ideas hybrid intelligent algorithms and various applications in transportation problem inventory system facility location allocation capital budgeting topological optimization vehicle routing problem redundancy optimization and scheduling Researchers practitioners and students in operations research management science information science system science and engineering will find this work a stimulating and useful reference

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Uncertain Graph and Network Optimization Bo Zhang, Jin Peng, 2022-05-03 This first book focuses on uncertain graph and network optimization It covers three different main contents uncertain graph uncertain programming and uncertain network optimization It also presents applications of uncertain network optimization in a lot of real problems such as transportation problems dispatching medical supplies problems and location problems The book is suitable for researchers engineers teachers and students in the field of mathematics information science computer science decision science management science and engineering artificial intelligence industrial engineering economics and operations research

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Advanced technologies for planning and operation of prosumer energy systems Bin Zhou,Siqi Bu,Liansong Xiong,Hugo Morais, Junjie Hu,Jingyang Fang,Jian Zhao,Peng Hou,2023-04-28

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Special Issue on Uncertain Programming Modeling, Algorithms and Applications ,2013 **Proceedings of International Conference on Systems Science and Engineering (ICSSE '88) :**

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Electricity Supply Planning when Demand is Uncertain Robert Boyd,1978 **INFOR.** ,2005 *Tools for Making Acute Risk Decisions* ,1994-08-15 The complexity of today s risk decisions is well known Beyond cost and risk there are many other factors contributing to these decisions including type of risk such as human injury or fatality the economic impact on the local community profitability availability of capital alternatives for reducing or eliminating the risk costs of implementing alternatives codes standards regulation and good industry practice This book presents a large range of decision aids for risk analysts and decision makers in industry so that vital decisions can be made in a more consistent logical and rigorous manner Though primarily aimed at the process industry this book can be used by anyone who makes similar decisions in other industries including those in management science **Machine Learning and Uncertain Reasoning** Brian R. Gaines,John H. Boose,1990 **Programming Under Uncertainty** Roger Jean-Baptiste Robert Wets,1965

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