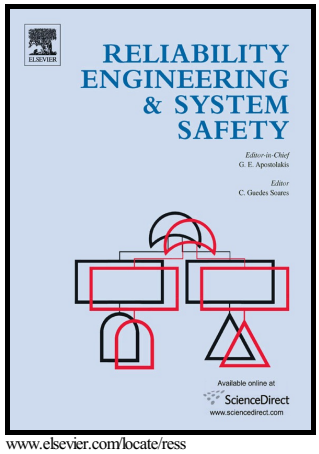

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MAINTENANCE PROCESSES MODELLING AND OPTIMISATION

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Abstract
A Maintenance Procedure is conducted in order to prevent the failure of a system or to restore the functionality of a failed system. Such a procedure consists of a series of tasks, each of which has a distribution of times to complete and a probability of being performed incorrectly. The inclusion of tests can be used to identify any maintenance errors which have occurred. When an error is identified it can be addressed through a corresponding correction sequence which will have associated costs and add to the maintenance process completion time. A modified FMEA approach has been used to identify the possible tests. By incorporating any selection of tests into the maintenance process it can then analysed using a discrete-event simulation to predict the expected completion time distribution. The choice of tests to perform and when to do them is then made to successfully complete the maintenance objective in the shortest possible time using a genetic algorithm. The methodology is demonstrated by applying it to the repair process for a car braking system. The developed method is suitable for application in abroad range of industries.

Keywords: Maintenance, Optimisation, Failure Mode and Effect Analysis, Discrete-event simulation, Genetic algorithm, System availability

1 INTRODUCTION

In order to repair hardware failures and restore functionality of hardware, a maintenance procedure (MP) is performed by a sequence of tasks [1]. It may be possible to perform a task incorrectly or for a task to take too long to complete. Since there is frequently a time limit on the window of opportunity to conduct the repair, both of the undesirable outcomes can be considered as failures of the MP. The objective of this research is to develop a means by which any task failure occurring during performance of an MP can be identified and subsequently rectified to restore the hardware functionality in as short a time as possible.
To achieve this objective a modelling approach is introduced in this paper which is conducted in three phases. The first phase identifies all of the errors that can occur in carrying out the process, along with tests which can be performed, and when they can be performed them, in order to identify these mistakes. For each test there is a correction process defined which describes the list of tasks which must be performed in order to correct the error identified. These tasks will also have associated time distributions indicating their duration to completion. Since the tests themselves need extra time to be conducted excessive testing could slow down the MP execution [2]. The full description of any maintenance process will then be constructed of the tasks required to conduct the maintenance along with the selected tests and corrective actions embedded in it. The effectiveness of any such process is