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A Threshold Based Proactive Maintenance Policy for Multi-Component Systems using DBNs

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Abstract

Today, with the ever-increasing technology, the environments in which companies are in competition have also increased and most companies have started to use machines that are more technological and require less manpower. While this may seem like an advantage in many respects, the complexity of the machinery used complicates many things. At the beginning of these difficulties is the determination of the maintenance policies of the machines. The occurrence of an unexpected malfunction in such systems causes serious problems such as product delays, lost sales and customer dissatisfactions. On the other hand, over-maintenance to reduce unexpected downtime can lead to unnecessary maintenance costs. In order to achieve the balance, it is of great importance to reduce reactive maintenance by keeping the number of proactive maintenance at the optimum level. In this study, a threshold based proactive maintenance policy is presented for multi-component systems where there exist stochastic and structural dependencies among the components. The proposed strategy is a predictive one that determines the proactive maintenance times of the system by considering the current system reliability. A tabu procedure is also proposed within the strategy to prevent the same component from being repeatedly selected for maintenance when frequent proactive maintenance is planned. Dynamic Bayesian networks, which are successful in expressing the dependencies and time based relations between components, is used to model the system and to compute the required inferences. As a case study, the policy is simulated on a regenerative air heater system which is used in thermal power plants and compared with other policies under different scenarios. The results indicate that the threshold based proactive policy gives the minimum maintenance cost in almost all scenarios. Moreover, it is also successful in decreasing the number of maintenance in a planning horizon due to its effective component selection method at a maintenance time.

Keywords
Proactive maintenance, Multi-component systems, Dynamic Bayesian networks, Tabu procedure

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Biographies

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