A Condition-Based Maintenance Policy for Multi-Unit Systems Subject to Deterioration

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Abstract : In this paper, we propose a condition-based maintenance policy for multi-unit systems considering the existence of economic dependency among units. We consider a system composed of N identical units, where each unit deteriorates independently. Deterioration process of each unit is modeled as a three-state continuous time homogeneous Markov chain with two working states and a failure state. The average production rate of units varies in different working states and demand rate of the system is constant. Units are inspected at equidistant time epochs, and decision regarding performing maintenance is determined by the number of units in the failure state. If the total number of units in the failure state exceeds a critical level, maintenance is initiated, where units in failed state are replaced correctively and deteriorated state units are maintained preventively. Our objective is to determine the optimal number of failed units to initiate maintenance minimizing the long run expected average cost per unit time. The problem is formulated and solved in the semi-Markov decision process (SMDP) framework. A numerical example is developed to demonstrate the proposed policy and the comparison with the corrective maintenance policy is presented.

Keywords : reliability, maintenance optimization, semi-Markov decision process, production

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