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Comparison of Two Maintenance Policies for a Two-Unit Series System Considering General Repair

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Abstract : In recent years, maintenance optimization has attracted special attention due to the growth of industrial systems complexity. Maintenance costs are high for many systems, and preventive maintenance is effective when it increases operations' reliability and safety at a reduced cost. The novelty of this research is to consider general repair in the modeling of multi-unit series systems and solve the maintenance problem for such systems using the semi-Markov decision process (SMDP) framework. We propose an opportunistic maintenance policy for a series system composed of two main units. Unit 1, which is more expensive than unit 2, is subjected to condition monitoring, and its deterioration is modeled using a gamma process. Unit 1 hazard rate is estimated by the proportional hazards model (PHM), and two hazard rate control limits are considered as the thresholds of maintenance interventions for unit 1. Maintenance is performed on unit 2, considering an age control limit. The objective is to find the optimal control limits and minimize the long-run expected average cost per unit time. The proposed algorithm is applied to a numerical example to compare the effectiveness of the proposed policy (policy I) with policy Ⅱ, which is similar to policy I, but instead of general repair, replacement is performed. Results show that policy I leads to lower average cost compared with policy Ⅱ.

Keywords : condition-based maintenance, proportional hazards model, semi-Markov decision process, two-unit series systems
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