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Joint optimal lot sizing and preventive maintenance policy for a production facility subject to condition monitoring

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Abstract

In this paper, we consider the joint optimization of economic manufacturing quantity (EMQ) and preventive maintenance (PM) policy for a production facility subject to deterioration and condition monitoring (CM). Unlike the previous joint models of EMQ and maintenance policy which used traditional maintenance approaches, we propose the proportional hazards model (PHM) to consider CM information as well as the age of the production facility. The deterioration process is determined by the age and covariate values and the covariate process is modeled as a continuous-time Markov process. The condition information is available at each inspection epoch, which is the end of each production run. The hazard rate is estimated after obtaining the new information through CM. The problem is formulated and solved in the semi-Markov decision process (SMDP) framework. The objective is to minimize the long-run expected average cost per unit time. Also, the mean residual life (MRL) of the production facility is calculated as an important statistic for practical applications. A numerical example is provided and a comparison with the age-based policy shows an outstanding performance of the new model and the control policy proposed in this paper.

Keywords: Condition-based maintenance (CBM), Semi-Markov decision process (SMDP), Proportional hazards model (PHM), Economic manufacturing quantity (EMQ).

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