Parameter Estimation for Condition Based Maintenance with Proportional Hazard Model[*]

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Abstract

Condition Based Maintenance with imperfect observations and a failure rate that follows the Proportional Hazards Model has been given some consideration by researchers. They are concerned with finding a maintenance policy that satisfies a set of criteria and that inform the practitioners when the maintenance action should be launched and what the associated action should be. Any maintenance policy is based on a model that characterizes the system's properties. A major concern of practitioners is to estimate the model's parameters correctly. In this research we introduce an algorithm to estimate the model's parameters when the system's observations are imperfect and the system's failure rate follows Cox's Proportional Hazards Model. Maximum Likelihood Estimation (MLE) algorithm is used and an example is solved.

Key words: Maintenance (Condition Based), Parameter Estimation, Maximum Likelihood Estimation, Imperfect Information, Proportional Hazards Model.

1   Introduction

Maintenance activities are traditionally categorized either as corrective maintenance or preventive maintenance. Corrective maintenance is performed after the system's failure. Since this can be very costly, several researchers suggested replacing the system based on its survival and failure history. This approach is known as preventive maintenance. It tries to prevent the system from catastrophic failure by performing preventive replacements at specific points in time.

Preventive maintenance is based on the system's age, but this is not the only determinant factor affecting the time-to-failure. The system's condition can also influence its time-to-failure. Since few decades, some 'Condition Based' or predictive maintenance approach has been used by analysts and practitioners. Based on this approach, system's condition obtained at observation points is the key parameter to set the appropriate maintenance time and action. Maintenance based on predictive approach is called Condition Based Maintenance (CBM), also referred to as predictive maintenance [1].

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