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Sensor-Based Calibrations to Improve Reliability of Systems Subject to Multiple Dependent Competing Failure Processes

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Abstract

Reliability models with sensor-based calibrations are presented for systems or devices subject to dependent competing failure processes of soft failure due to degradation process and hard failure according to shock process. Shock magnitudes to indicate the hard failure are considered in terms of two patterns, inter-arrival times and arrival times. The soft failure is indicated by overall degradation measurement comprising of internal continuous degradation measurement and additional degradation damage caused by the shock process. By sensors, instant calibrations are carried out to rejuvenate the additional degradation damage. Then explicit reliability expressions are derived for the dependent competing failure system whose internal degradation measurement is described by the general degradation path model. And a simulation procedure is proposed to model the internal continuous degradation measurement indicated the Wiener process. Meanwhile, the usefulness of the proposed models is demonstrated by the numerical example. The results are illustrated that the proposed model with the instant calibrations are available to improve system reliability and make the system to operate in a higher safety in applications.

Keywords: Dependent competing failure; Degradation; Poisson process; Calibrations; Inter-arrival time; Arrival time; Simulations

1. Introduction

Imposed external damage created by outside stochastic shocks is a critical part leading to the failure of a system. In the past, the shocks could not always be tracked

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