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Availability and Maintenance Modeling of a Repairable System Incorporating a Hybrid Hazard Rate Model

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ABSTRACT

This research focuses on the modeling of availability and maintenance in periodically inspected repairable competing risk systems. It introduces a nuanced approach by incorporating imperfect preventive maintenance. It utilizes a hybrid hazard rate model, considering factors such as age reduction and hazard rate increment after each maintenance activity. The study aims to improve system safety and performance by providing authentic data on system behavior, which is crucial for advancing maintenance modeling methodologies. The maintenance strategy involves the strategic implementation of imperfect preventive maintenance during inspections and precise corrective maintenance upon failure detection to minimize overall maintenance costs.

The paper calculates the system's instantaneous and steady-state availability, employing sensitivity analysis to explore the impact of inspection timing on system availability. Additionally, comprehensive analyses, including mean time to failure and cost evaluations, are conducted to identify the optimal frequency of inspections that minimizes total maintenance costs while ensuring acceptable levels of availability. The findings offer valuable insights into determining optimal inspection frequency and understanding the nuanced effects of imperfect maintenance on availability and reliability metrics in periodically inspected repairable competing risk systems.

To validate the study's robustness, a practical case example involving a wind turbine system is utilized, emphasizing the practical applicability of the research outcomes.

Keywords: Reliability; Hazard rate; Availability

How to Cite

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