

DOUTORADO (DO)

A HYBRID POLICY FOR PROTECTION SYSTEMS SUBJECT TO INTERNAL DEGRADATION AND EXTERNAL SHOCKS

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ABSTRACT

This paper aimed to develop an inspection and replacement policy for protection systems that can fail due to both internal degradation and external events (shocks), which accelerate their natural wear process. Our motivation was a circuit breaker whose function is to protect a distribution transformer against critical events (such as overload), to prevent disasters with exorbitant consequences. The modelling was conducted based on the delay time concept, in which the defective state precedes the failed state. In addition, the shock rate is directly influenced by the system state, following a non-homogeneous Poisson process. To approximate the model to real contexts, we consider that spares arrive from a heterogeneous population with items with distinct reliabilities. It is also assumed that there are conditions under which inspection errors (false positives and negatives) can occur. To validate the model, we performed a numerical application, which enabled us to identify the cost savings of the proposed policy compared to two other well-established policies. Moreover, insights are provided on which circumstances inspections should be intensified or not, in order to reduce the cost-rate. Finally, a web application was developed to allow the model to be widely accessible by any maintenance decision-maker without prior knowledge of mathematical modeling or programming languages.

Keywords: Reliability; Maintenance; Delay time model; Imperfect inspection; Shocks.

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Realização