Imperfect Repair Systems: Test and Model Selection

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An appropriate maintenance policy is essential to reduce expenses and risks related to equipment failures. A fundamental aspect to be considered when specifying such policies is to understand the behavior of the failure intensity for the systems under study. The usual assumptions of minimal repair (MR) at failures are not adequated for many real world systems, requiring the application of imperfect repair (IR) models. The purpose of this work is twofold: (1) propose a non-parametric test for MR against the IR alternative and (2) explore the classes ARA and ARI of IR models proposed by Doyen and Gaudoin (2004). A rank test based on a binomial distribution under MR hypothesis is proposed for the former one. Likelihood functions for ARA and ARI models are derived, assuming Power Law Process and a general memory m. The maximum of the likelihood function value was used as the criteria for model selection and also a graphical technique. This work was motivated by a real data set involving failures in trucks used by a mining company. The results after appling these methodologies, provided evidences that the trucks tend to fail more frequently over time, and also, that the repairs after failures tend to leave the equipment in a state between as good as new and as bad as old. These results are a valuable information for the mining company, and can be used to support decision making regarding preventive maintenance policy.

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