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Optimal Continuous Scheduled Time for a Cumulative Damage System with Age-Dependent Imperfect Maintenance

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Abstract : Many manufacturing systems suffer failures due to complex degradation processes and various environment conditions such as random shocks. Consider an operating system is subject to random shocks and works at random times for successive jobs. When successive jobs often result in production losses and performance deterioration, it would be better to do maintenance or replacement at a planned time. A preventive replacement (PR) policy is presented to replace the system before a failure occurs at a continuous time T. In such a policy, the failure characteristics of the system are designed as follows. Each job would cause a random amount of additive damage to the system, and the system fails when the cumulative damage has exceeded a failure threshold. Suppose that the deteriorating system suffers one of the two types of shocks with age-dependent probabilities: type-I (minor) shock is rectified by a minimal repair, or type-II (catastrophic) shock causes the system to fail. A corrective replacement (CR) is performed immediately when the system fails. In summary, a generalized maintenance model to scheduling replacement plan for an operating system is presented below. PR is carried out at time T, whereas CR is carried out when any type-II shock occurs and the total damage exceeded a failure level. The main objective is to determine the optimal continuous schedule time of preventive replacement through minimizing the mean cost rate function. The existence and uniqueness of optimal replacement policy are derived analytically. It can be seen that the present model is a generalization of the previous models, and the policy with preventive replacement outperforms the one without preventive replacement.

Keywords : preventive replacement, working time, cumulative damage model, minimal repair, imperfect maintenance, optimization
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