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Title of Thesis: Optimal maintenance policy for multi-component systems based on predictive information and environmental changes
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ABSTRACT

The total maintenance cost of multi-component systems can be reduced by grouping maintenance actions of several components. However, few studies have considered the maintenance crew constraints such as the limited number of available repairmen or the effect of both time pressure and fatigue on the maintenance crew due to grouping. This research contributes to the existing literature by introducing an enhanced maintenance optimization approach that considers the effect of maintenance crew loading due to grouping as well as the maintenance repairmen availability on the maintenance decisions of multi-component systems. A modified mathematical model is developed for evaluating the survival probability of each component, the failure probability function, the remaining useful life, and the total maintenance cost. For series components, positive and negative economic dependencies and structural dependencies are taken into consideration. Since analytical solutions to such models become complicated for a large number of components. Then, simulation is implemented to provide estimates of the associated costs with changes in the decision variables. Simulation results are validated by comparing them with the published analytical results in the literature. Using the simulation model, an optimization approach based on a genetic algorithm is developed to minimize the long-term mean maintenance cost per unit time considering the maintenance crew related constraints. According to the results of the proposed approach, the impacts of maintenance actions grouping and maintenance crew constraints on the maintenance planning are highlighted. Computational results show that the proposed maintenance optimization approach provides considerable maintenance cost savings and emphasizes the importance of considering the effect of maintenance work crew constraints in maintenance scheduling. The stochastic simulation process, component degradation, imperfect maintenance model and integrated GA optimization model, all of these are programmed and solved using the programming package MATLAB R2017b. The proposed maintenance optimization approach is a useful tool for the maintenance managers that experience the planning problem of deteriorating multi-component systems with the consideration of maintenance crew constraints and component dependencies. In addition, decision-makers can use the proposed approach to improve the financial behavior of maintenance processes.

Not more than 500 words