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Data driven maintenance policies optimization for manufacturing systems: A case study

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Abstract

This paper aims to develop a simulation-based framework to identify critical equipment, critical maintenance, and operational factors affecting plant performance (availability and maintenance cost). The study develops a framework that utilizes empirical maintenance data. Pareto analysis is employed to identify critical subsystems, while expert input is incorporated to derive model variables. A full factorial Design of Experiment (DOE) is employed to establish the variables with significant main and interaction effects on the plant's availability and maintenance cost. The framework is applied to a real case study of a manufacturing firm, where a simulation model is developed based on empirical maintenance and operational data, while considering the availability and maintenance cost as the performance measures. Simulation results highlight the bucket elevator as the critical subsystem. At the same time, spare parts importation probability, among other parameters like the preventive maintenance interval and utilization of 'adjust' maintenance action, significantly affects the performance (availability and maintenance costs) as interaction effects. The study provides a pragmatic reference model framework for practitioners to enhance

maintenance decision-making by identifying critical equipment, maintenance and operational parameters and disclosing their effect (main and interaction) on the plant performance (availability and maintenance cost). This study is one of the first to (i) investigate the maintenance and operational factors' main and interaction effects on maintenance cost, and (ii) integrate the spare parts importation probability as a factor affecting plant performance. The developed framework assists in determining critical systems to be optimized and considers various maintenance strategies simultaneously. Additionally, the study discovers the stochasticity of spare parts availability and replenishment and the interactions for decision support.
Keywords: Maintenance, availability, simulation, maintenance cost.