Optimization of Maintenance Schedule and Parameters for Critical Equipment in a Textile Mill through Statistical Synthesis of System Data and Time Between Maintenance Operations

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August 9, 2023

Abstract

Unexpected equipment failure in machines interrupts production schedules and creates costly downtime. Therefore, the importance of timely equipment maintenance is to extend the machine lifespan, prevent unplanned downtime, and reduce the need to buy equipment. Textile factories tend to have overcapacity of looms with inconsistent maintenance time schedules. The main objective of the research was to establish a suitable maintenance schedule time and parameters by assessing the state of maintenance practices of the critical equipment in the weaving section. The maintenance time schedules of rapier, and air-jet looms were studied. Weibull distribution, and Monte Carlo simulation were undertaken followed by regression analysis of the data. The setup of the Monte Carlo simulation entailed 1000 instances of the random values from the systems in the critical equipment. The data were optimized through Monte Carlos regression modeling and Weibull distribution analysis to get shape parameter and the scale parameter of 1.47 and 1683.46 hours. In conclusion, the findings indicated that weaving looms were the critical equipment. The model's shape parameter of 1.47 described a steady increase in the risk of wear-out failure during the early life of the machines. Also, the value of the shape parameter suggested early wear-out failure and premature failures after installation. The optimal time interval for maintenance operations was 1683.46 hours from the scale parameter. The findings indicated that looms had an inconsistent and incoherent maintenance time scheduling approach. According to the results, it is recommended that preventive maintenance schedules be done once every 1683.46 hours.

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