MASTER OF SCIENCE
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APPLIED SCIENCE

ESTABLISHING A VIBRATION THRESHOLD VALUE, WHICH ENSURES A NEGLIGIBLE FALSE ALARM RATE FOR EACH GEAR IN CH-53 AIRCRAFT USING THE OPERATIONAL DATA

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Rotating machinery, such as gears, plays an important role in control of an aircraft. The health of this machinery is a key ingredient to both platform safety and mission success, especially in military operations. The purpose of this thesis research is to establish a vibration threshold level for each particular gear in CH-53 aircraft such that, while minimizing in-flight risk, a negligible false alarm rate is obtained. This study uses Box-Jenkins time series modeling (ARMA) with regression, Mahalanobis distance metrics, goodness-of-fit tests, and the Bonferroni correction to explore the structure of the historical acquisition datasets for particular gear type and aircraft, to set vibration threshold values for "Warning" and "Alarm" situations. Although 28 datasets could not be modeled because of small sample sizes, the other 224 data sets were successfully modeled using ARMA with regression modeling techniques. The Mahalanobis distance metric was then used to set a threshold value of "Warning" and "Alarm" for each gear type. These threshold values were then checked with new data: 200 outliers for "Warning" and 69 outliers for "Alarm" were detected. These outliers might be evaluated as false alarms.

KEYWORDS: Box-Jenkins Time Series Modeling, ARMA, Mahalanobis Metric, Goodness of Fit Tests, Bonferroni Correction

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