Predictive Linear Regression Model for Mechanical Vibrations in a 187 MW Gas-Turbine Generator Operating Under Combined Cycle

Ahmed I. Abeda, b and Loh Wei Pingb

aSchool of Arts & Sciences, American International University, Kuwait

bSchool of Mechanical Engineering, Engineering Campus, Universiti Sains Malaysia, 14300 Nibong Tebal, Seberang Perai Selatan, Penang, Malaysia.

**Abstract**

A power generating unit's fundamental component is a gas turbine (GT), consisting of a compressor, a turbine, and a generator to convert thermal energy into electrical energy. The rotating turbine is prone to high vibrations, potentially leading to failures. Numerous studies have reported various simulation techniques, including MATLAB, Pro-Engineering, and CFD to develop mathematical models and simulators of GT components. These models typically focus on specific physical parameters such as temperature, pressure, rotational speed, and load variations. Despite extensive researches, gaps remain in understanding the relationship between mechanical vibrations in GT generators and their underlying causes. This study addresses these gaps using statistical analysis and data mining techniques on a large dataset of mechanical vibrations from GT components in a thermal power unit. Data mining techniques were employed to create mechanical vibration velocity models, linking various operational parameters and conditions: vibration velocities and amplitudes on the GT power unit main components (compressor, turbine, and generator). Linear Regression algorithm in WEKA software was used to construct two linear models for the mechanical vibration velocity of the GT generator’s support bearings. The models demonstrated correlations of 99% and 92%, respectively, for the front and rear support bearings. Validation using a supplied test set of case study data confirmed an accuracy rate of 99% for both models. Ultimately, these predictive mechanical vibration models pave the way for more effective maintenance practices and improved turbine reliability in power generation.