System Modeling and Vibrational Analysis on a Pumping System in a Building at The Pennsylvania State University

Overview
The pumping system in a building at The Pennsylvania State University is not performing at its optimal level. The task was to establish a set of recommendations to restore the system. The project's main challenges include obtaining all pertinent information and data to model the pumping system and determining the root cause of the problem through vibration analysis.

Objectives
The goal of the project is to detect the fault causing the pumping system to operate at an unfavorable condition and then provide recommendations to restore the system. System modeling and simulation, and component vibration analysis were performed to establish the recommendations as well as the projected cost saving.

Approach
- The customer needs were obtained by talking to the sponsor and site maintenance engineers.
- The concepts were selected based primarily on the sponsored products which included a proprietary computer program and condition based monitoring devices.
- No patents were reviewed since the products were sponsored. However, the products provided assessed by comparing with other existing products from external searches.
- The team met with the sponsor and site maintenance engineers frequently to discuss the analyses performed as well as to collect pertinent information and data.
- A model was developed on the software provided to analyse and simulate the pumping system.
- The results generated were compared with the system's optimal conditions to determine the amount by which the system can be improved and to project the estimated cost saving.
- Vibration signals were collected and analysed using the sponsored condition based monitoring devices that are pre-installed on the faulty system components.
- The frequency spectrums of the motor's vibration signals were generated using the Fast Fourier Transform method on the computer software provided.
- The results from the frequency spectrums were compared with the ones in “Vibration Diagnostics Handbook” to determine the possible root cause of the problem.

Outcomes
- The motors in the air handler units of the system are identified to be experiencing some misalignments and some mechanical looseness.
- The system is operating at an efficiency level that is 8.59% lower than its optimal condition.
- The pumping system is projected to save $156.20 annually as a result of the recommendations.