Advanced Signal Processing Algorithms For extracting information from Vibration Signals

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Introduction

◈ K.N.Toosi University of Technology, in collaboration with MECO(MAPNA Electric & Control Engineering & Manufacturing Co.), has developed a vibration monitoring analysis module. The main goal of this module is condition-oriented maintenance .The combination of the in-depth knowledge extracted from raw vibration data via our vibration monitoring solution leads the experts to make a precise decision on the maintenance actions. As a result, less downtimes will be required in order to accomplish a repair task. provides monitoring and steady-state and transient vibration analysis. This module is implemented and used for Condition monitoring of several turbines and power plants.

◈ Monitoring, analysis, and data archiving of vibration data are performed via a software package consisting of two main parts
- Steady state analysis
- Transient Analysis

Steady-State Vibration Analysis

◈ The system's overall status (including turbine, compressor, OCE, and CE generator bearings) is reported via basic frequency-domain and time-domain features that are calculated online. These features consist of the frequency spectrum, orbit, and time-based plot. Efficient monitoring and setting threshold on these features results in assessing normal operation, detecting the gradual faults, long-term monitoring of vibration behavior, and predicting future behavior. This category can be divided into two subsets; time-domain analysis and frequency domain analysis.
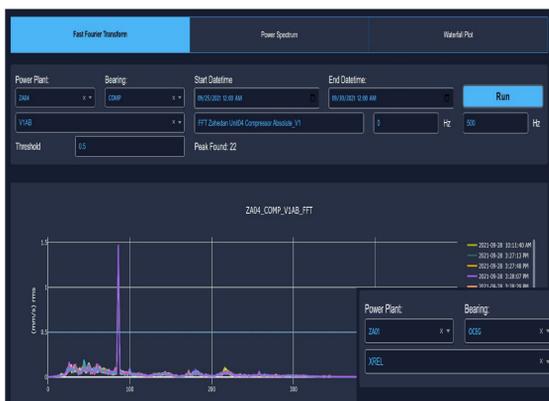

Frequency Steady-State Analysis

Orbit Steady-State Analysis

Time based Steady-State Analysis
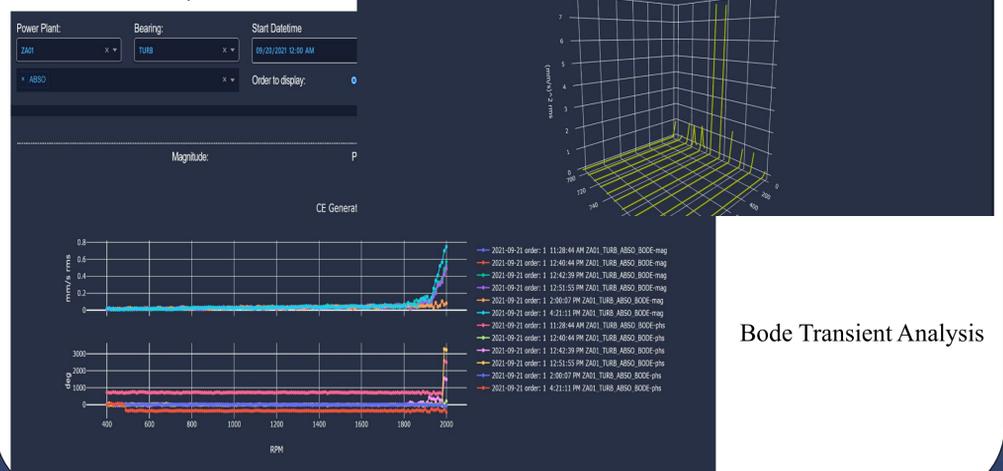
RMS-Peak Steady-State Analysis
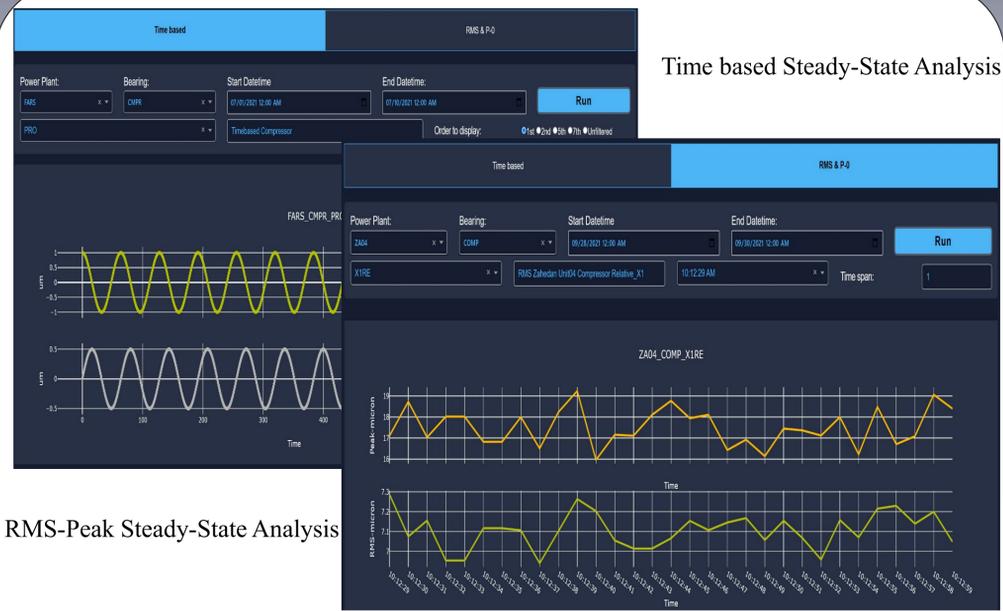
Transient Vibration Analysis

The system behavior in transient scenarios like run-up and shut-down is very critical for advanced vibration analysis. In this part, several important trends like polar, cascade, bode, and shaft centerline plots are extracted from vibration signals. These trends are available while the speed profile of the system is variant. Therefore, advanced vibration monitoring analysis is achievable in relation to RPM variation. Order phase and magnitude, time-based order plot, and order orbit plot are also calculated in transient scenarios. This category can be divided into two subsets; time-domain analysis and frequency domain analysis.
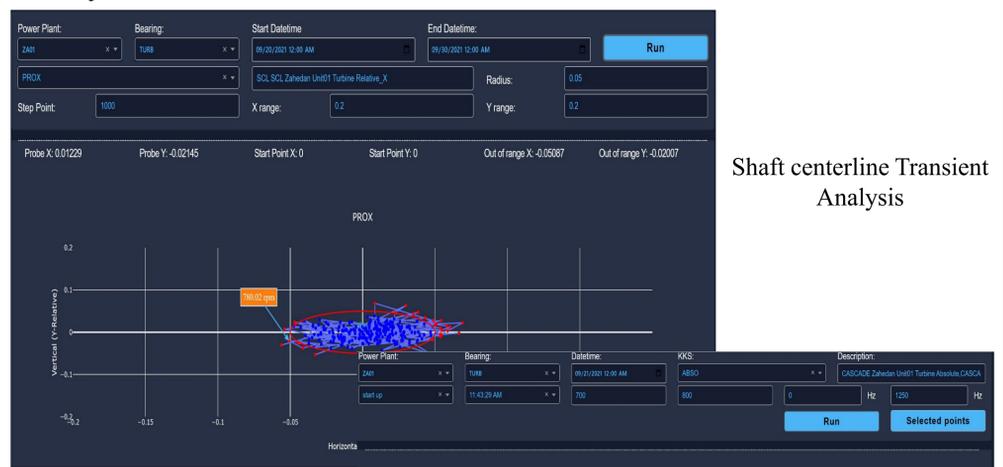
Shaft centerline Transient Analysis

Cascade Transient Analysis

Bode Transient Analysis