DETECTION PROCEDURES FOR SHAFT MISALIGNMENT DETECTION: AN OVERVIEW

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Abstract

There are three different types of shaft misalignment: (i) shaft angular misalignment in which shaft centrelines intersect, (ii) shaft parallel misalignment in which shaft centrelines are parallel and (iii) a combined angular/parallel misalignment. Various procedures of misalignment detection are developed: analytical and experimetal.

The coupled rotor system is modelled using Timoshenko beam and dynamics of the shaft system is investigated. Recently, the nonlinear damping and stiffness properties are also included and the presence of superharmonic components is presented. Along with lateral vibrations, axial and torsional vibrations are mathematically described and nature of the vibration response for the case of misalignment is examined. Variety of techniques are utilized harmonic analysis: Fourier transformation, the least square technique, non parametric and parametric methods, harmonic balance method, wavelet analysis, artificial neural network, fuzzy logic, support vector machines, improved discrete Fourier transformation etc. Diagnostic features in the fast Fourier transform (FFT) of vibration response related to the type of misalignment have been revealed. A programme for dynamic of systems of bodies MSC.ADAMS is developed where the Fourier transformation in frequency spectrums was applied for detction of symptoms of failure in misalignment of rotating machines.

Based on theoretical consideration measuring procedures for misalignment detection are developed. The simplest and more traditional detection method is the vibration measuring. Based on the fast Fourier transformation it is concluded that the misalignment gives the peak for 2X frequency of vibration. One of the procedures is the shock pulse measurement. Acoustic emission technique can be used as a reliable technique for misalignment detection, providing enhancements over vibration analysis. The shaft misalignments can be detected by temperature monitoring. The early detection of shaft misalignment is obtained by measuring of temperature of couplings using thermal imaging camera or by thermography inspection. Measuring and estimating the torque with torque sensors available the misalignment fault detection. Recent measurement system comprises the laser light source for misalignment detection. Using the laser interferometer and the signal encoder the signal of misalignment is obtained. Finally, the monitoring of shaft misalignment is possible with a non-contact laser.

Key words: shaft misalignment, fault detection, measuring procedures.