



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: **ESTIMATION OF MULTI-FAULT PARAMETERS IN A CRACKED-WARPED ROTOR SYSTEM INTEGRATED WITH AN ACTIVE MAGNETIC BEARING**

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**SHORT ABSTRACT**

In the present work, mathematical modeling of cracked warped internally damped rotor-AMB developed considering without and with residual bow for 2 DOFs, DOFs and multi-DOFs system are developed. Identification algorithms are developed based on the frequency domain equation of motion and full spectrum amplitude and phases after compensation are input to the identification algorithms to estimate the multiple fault parameters. Numerical simulations are done using ode45 solver in SIMULINK Matlab environment and checked the robustness of the technique to measurement noise and bias error.

Furthermore, the experimental investigations are carried out to verify the theoretically developed multiple fault identification algorithms for the cracked warped rotor integrated with AMB proposed. The transverse breathing behavior of crack simulated is established through an artificially generated fatigue crack in the shaft. The PID control strategy is used for producing electromagnetic forces around the 8 pole magnetic actuator to suppress the amplitude of vibration of the rotor bearing system. The measured vibration signal from the rotordynamic test bench are converted into full spectrum response using Fast Fourier Transform (FFT) to elucidate the amplitude and phase of multiple harmonic signal of both displacements and control currents of AMB signals. The full spectrum amplitude and phase after compensation is utilized in the developed identification algorithm to quantify multiple fault parameters such as external and internal damping, unbalance and residual shaft bow and their phases, translational and rotational additive stiffness due to the presence of crack and AMB parameters associated with the test rig. To validate the estimated results, balancing is done for the test rotor and found a good amount of the reduction in vibrational amplitude. As a comparison the time domain and frequency domain response of cracked shaft and healthy shaft is also presented. The multiple fault identification methodology gives an insight to the quantification of various fault parameters in a rotor and viable its practicability.