Thesis Title: RELIABILITY MODELING OF ROTOR SYSTEMS

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THESIS ABSTRACT

This research work proposes reliability models for the rotor systems which are subjected to the faults under dynamic conditions.

The first model is a theoretical model which utilizes the mathematical fault model to compute the additional dynamic stress due to the fault. This additional stress due to fault is incorporated in the proposed reliability model to compute the reliability of the system, for the different fault parameters.

The second model is based on the experimental methodology. In this model, the additional dynamic stress due to fault is computed from the measured system (machine) signature. The residual generation technique which compares the faultless and faulty machine signatures to construe the additional stress is utilized in this model. This deduced additional stress from the system signature due to fault is incorporated in the proposed reliability model to compute the reliability of the system. This model is demonstrated in the research work by measuring the vibration signature of the system.

In both the models to compute the reliability, a stress-strength interference approach together with a simulation-based methodology is used for analysis and modeling for this complex relationship. In this research work, both models are utilized to construct the specific reliability models for the most commonly occurring rotor system faults *viz.* mass imbalance and misalignment. Numerical illustrations are included to validate the models.

The theoretical and experimental models can be used for the systems having inherent faults to establish the safe operating parameters such as rotating speeds and the allowable fault levels. Especially, the theoretical model can be utilized during the designing and proto-type development of the industrial rotor systems, while the experimental model can be used during the actual functioning of the system for safe and reliable operations.

The proposed models can be extended to the other rotor system faults also. These models can be utilized in any real-life systems such as aviation engines, ship propellers, electricity generating wind turbines etc.