

## Documents

Deshpande, L.G., Sawalhi, N.M., Randall, R.B.

### **Bearing fault simulation using finite element model updating and reduction techniques**

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#### **Abstract**

Simulation provides an effective method to generate vibration signals in the presence of machine faults such as in gears and bearings. Lumped parameter models (LPMs) and the LPM combined with a reduced finite element (FE) model of the casing were previously used to simulate localised and extended bearing faults in the inner and outer race. The analysis of the vibration signals based on the above techniques clearly indicated the presence of localised inner and outer race faults through envelope analysis in a high frequency band. However, the simulated results showed poor spectral matching over a wide frequency range when compared with the test results. There were also discrepancies in the low frequency region where extended faults in the outer and/or inner race interact with and modulate gearmesh frequencies. This paper describes FE-Test correlation wherein the FE model of the gearbox casing is updated based on experimental modal analysis prior to the model reduction. The updated casing model is subsequently reduced using the Craig Bampton method of component mode synthesis subject to the frequency range of interest. The greatly reduced mass and stiffness matrices are imported into a simulation model developed earlier which has the capability of simulating time-varying stiffness nonlinearities and geometric faults for both gears and bearings. This paper mainly highlights the simulation of vibration signals in the presence of localised inner race faults. The simulated results with the updated model are compared with the measured signals.

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