

Mistuning in Radial Inflow Turbines

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Abstract : One of the common failure modes of the diesel engine turbochargers is high cycle fatigue of the turbine wheel blades. Mistuning of the blades due to the casting process is believed to contribute to the failure mode. Laser vibrometer is used to characterize mistuning for a population of turbine wheels through the analysis of the blade response to piezo speaker induced noise. The turbine wheel design under investigation is radial and is typically used in 6-12 L diesel engine applications. Amplitudes and resonance frequencies are reviewed and summarized. The study also includes test results for a paddle wheel that represents a perfectly tuned system and acts as a reference. Mass spring model is developed for the paddle wheel and the model suitability is tested against the actual data. Randomization is applied to the stiffness matrix to model the mistuning effect in the turbine wheels. Experimental data is shown to have good agreement with the model.

Keywords : vibration, radial turbines, mistuning, turbine blades, modal analysis, periodic structures, finite element

Conference Title : ICTFD 2014 : International Conference on Turbomachinery and Fluid Dynamics

Conference Location : Sydney, Australia

Conference Dates : December 15-16, 2014