

Fact and Fallacy in Linear Rotordynamics Analysis

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ABSTRACT

According to an intuitively appealing line of thought, a rotor system is divergent above a critical speed, a conclusion that is manifestly false. The known stability of supercritical rotors is usually explained as an example of a vibrating system operating above a resonance. Consideration of two simple lumped-parameter systems, and the associated linear mathematical models, shows that neither point of view is wholly correct, and helps sort out fact from fallacy.

To many gas turbine industry alumni, a supercritical rotor is one that runs above its third critical speed, a fallacy based on the notion that the first two criticals are always heavily damped bearing modes. Strain energy distributions are the key to an objective assessment.

The appearance of fallacy is occasionally necessary to get useful results from a linear model. The appropriate representation of roller bearings, built-up rotors and gyroscopic effects can be counter-intuitive.

Keywords

Rotordynamics, analysis, linear, vibration, fundamentals.