

**IDENTIFICATION OF ANISOTROPY AND ASYMMETRY IN ROTOR SYSTEMS
FROM DIRECTIONAL FREQUENCY RESPONSE ESTIMATES**

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ABSTRACT

Anisotropy and asymmetry of rotor systems are important factors to determine dynamic characteristics including stability and response of rotors. Directional frequency response functions (dFRFs) are known as a powerful tool for detecting the presence and degree of anisotropy or asymmetry. However when a rotor system possesses both anisotropy and asymmetry, since the differential equation of motion is characterized by periodically time-varying coefficients, it is difficult to perform the conventional modal analysis and thus to estimate dFRFs accurately. In this paper, an estimation method, based on a modal analysis method developed for rotor systems with both anisotropy and asymmetry, is newly developed. This method essentially introduces a multi-input/single-output relation for estimation of dFRFs in the complex domain, as a finite degree-of-freedom time-varying equation is transformed into an infinite degree-of-freedom time-invariant one, employing the modulate coordinate. The spectral leakage and input/output measurement noise effect on the dFRF estimates are also evaluated. Finally a finite element model update method is applied to identify the anisotropy and asymmetry degree of rotor systems using estimated dFRFs. The effectiveness for the estimation method is demonstrated by numerical examples and experiments.

Keywords: Directional frequency response functions, Spectral estimation, Asymmetric rotor, Anisotropic stator