## Prediction of the Torsional Vibration Characteristics of a Rotor-Shaft System Using Its Scale Model and Scaling Laws

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**Abstract :** This paper presents the scaling laws that provide the criteria of geometry and dynamic similitude between the fullsize rotor-shaft system and its scale model, and can be used to predict the torsional vibration characteristics of the full-size rotor-shaft system by manipulating the corresponding data of its scale model. The scaling factors, which play fundamental roles in predicting the geometry and dynamic relationships between the full-size rotor-shaft system and its scale model, for torsional free vibration problems between scale and full-size rotor-shaft systems are firstly obtained from the equation of motion of torsional free vibration. Then, the scaling factor of external force (i.e., torque) required for the torsional forced vibration problems is determined based on the Newton's second law. Numerical results show that the torsional free and forced vibration characteristics of a full-size rotor-shaft system can be accurately predicted from those of its scale models by using the foregoing scaling factors. For this reason, it is believed that the presented approach will be significant for investigating the relevant phenomenon in the scale model tests.

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Keywords : torsional vibration, full-size model, scale model, scaling laws

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