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Development of a Rotordynamic Analysis Model for Rotor Shaft of SMART MCP

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Abstract

A rotordynamic analysis model for rotor shaft assembly of SMART MCP was developed. The rotor shaft assembly consists of vertical spinning shaft, impeller, water lubricated bearing and canned motor. The analysis model includes journal bearing model, gap model between the motor stator and rotor, motor dynamic model, and impeller dynamic model. Reynolds' equation is applied to predict the stiffness and damping of the axially grooved journal bearings. Its solution is obtained by finite different method. Black's equation is used to calculate the stiffness, damping, and added mass for the small gap filled with water between the stator and rotor of motor. Dynamic parameters of impeller are calculated using Childs' equation which depicts the hydraulic imbalance forces. Electromagnetic force of canned motor is calculated using Iwata's model. The developed analysis model was applied to investigate the critical speeds, vibration mode shapes, and damped responses at bearings of the conceptually designed MCP rotor shaft.