5-Axes Levitation of a Rotor Towards Indigenisation of the Magnetic Bearing Technology

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ABSTRACT

An attempt has been made to demonstrate the complete levitation of a rotor supported on two radially active magnetic bearings (AMB) and two axially passive magnetic bearings (PMB) resulting in 5-axes levitation. In the present work a rotor weighing 4 kg has been levitated completely without any physical contact with the stator. The active magnetic bearings consist of electromagnetic actuator, proximity probe for position measurement, feedback controller and current feedback type power amplifier. The active bearings work in the mode of attraction, which makes the system inherently unstable. Herein, a direct output feedback control scheme based on proportional and derivative of position signal has been employed to achieve stability. The passive bearings consisting of axially magnetized circular permanent magnets work in the mode of repulsion. The design of the electromagnetic actuator has been carried out considering load carrying capacity of the AMB, core loss and the resistive loss in the coil, so that the temperature rise in the core as well as in the coil is within allowable limit. Design of the feedback controller is based on direct output feedback control scheme. The feedback controller parameters have been selected appropriately to generate required stiffness and damping in the AMBs for stable levitation of the rotor.

KEY WORDS: Rotor, Active Magnetic Bearing, Levitation, Feedback Control.