Simulation and Practical Control of a Shaft Supported by a Radial Active Magnetic Bearing

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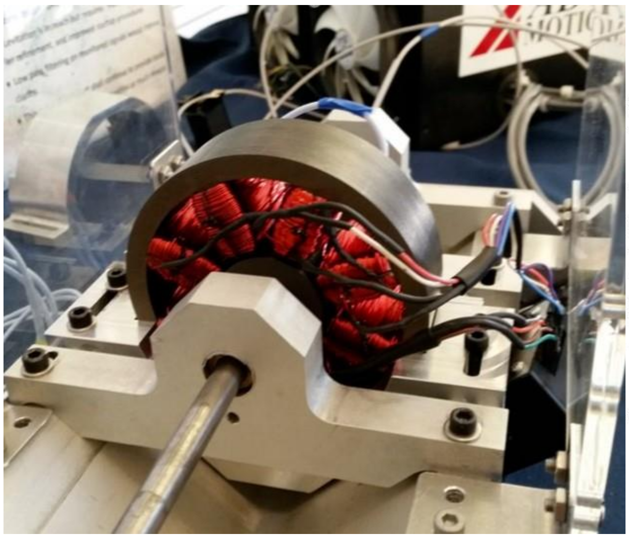

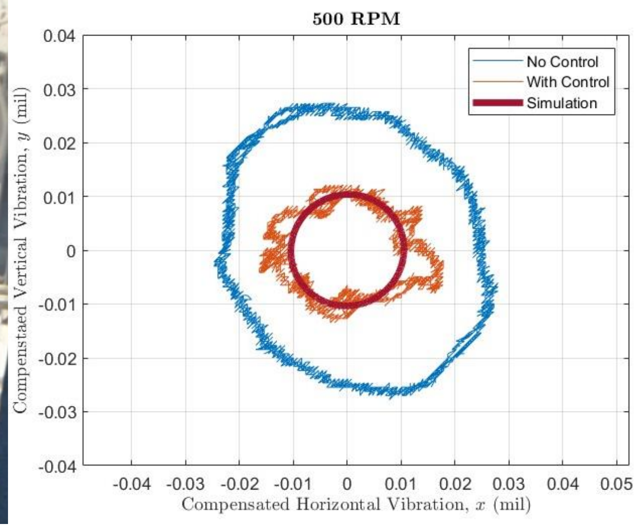

This thesis aimed to model a rotor supported by an active magnetic bearing (AMB). The magnetic force equation due to a single electromagnet was first derived which served as the basis of AMB modeling. The finalized model utilized Matlab, Simulink, and MSC Adams to simulate a rotor supported by an AMB. Matlab and Simulink were used to model the AMB control system and actuator output. MSC Adams was used to capture the dynamics of a flexible rotor. This model was verified by comparing the model's simulated vibration to real vibration data measured from a modified Bently Nevada rotor kit equipped with an AMB system in Cal Poly's Vibrations Lab. This AMB system was designed and manufactured by a Cal Poly Senior Project team in 2016. The AMB system was enhanced to include a newly designed current sensing PCB to directly measure the current running through the AMB coils. To make full use of the AMB system, a new fully customized LabVIEW program was created capable of controlling the shaft and producing high resolution rotor monitoring data such as orbit, amplitude bode, and full spectrum plots. Use of the LabVIEW program with correct controller gains resulted in vibration reduction. Through controller tuning it was found that derivative gain has the highest impact on the controller's ability to reduce vibration.

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