Repairing a MBC500 and implementing a PD-Control

Magnetic bearing with PD-control

Student

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Introduction: Magnetic bearings are increasingly utilized in industrial machines such as turbines, compressors, pumps, generators and motors. This growth is manly due to modern computer-based control technology and the advantages of magnetic bearings. Magnetic bearings have almost none to zero friction. Thus, they do not need lubricants and therefore have almost no mechanical abrasion. However, making a rotor levitate is everything else than trivial. This is due its non-linear behavior and dynamics. Nonetheless, it is a popular example in control theory.

To possess a setup for educational purposes the school purchased a second-hand MBC 500. The MBC 500 is a magnetic bearing consisting of two active radial magnetic bearings at the end of the rotor. However, the purchased device did not work properly. Therefore, the first objective during this project was to repair it.

The main objective is to design a sufficient controller which actively levitates the shaft.

Approach / Technology: For a simplified workflow during measurement and controller-design, I chose to work with

Simulink's real-time platform Speedgoat. After deciding which hardware I will use for the new setup, I've had some unknown troubles with the hardware, which first had to be found and then bypassed with a suitable work-around. After getting the new circuit functional, a simple PD-controller was introduced, trying to levitate the rotor.

Conclusion: The MBC 500 is revised and therefore controllable and observable. To set up the new hardware a great amount of effort went into analysing the behaviour of the current driver. As a consequence the control-designing was tenuous. Nonetheless, a functional PD-controller, able to levitate the shaft in one bearing, was designed with the concept of trial and error. However, additional work must be done in identification and robust control.
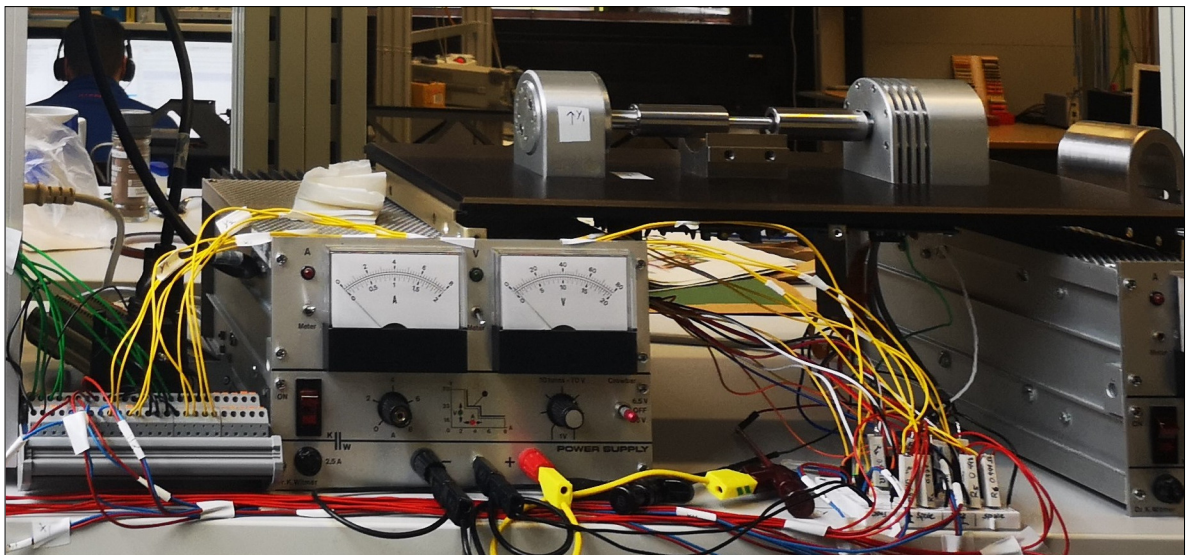
The purchased MBC500
launchpointeps.com

Levitating rotor on one side of the bearings (left)
Own presentment
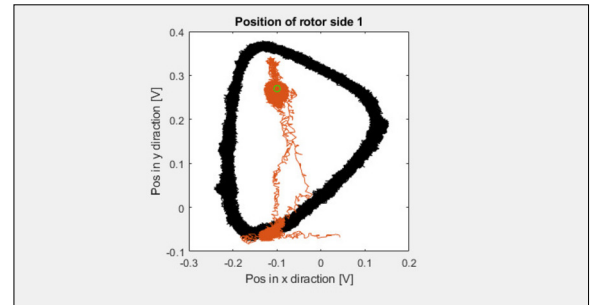
The new setup to control the MBC500
Own presentment

Examiner
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Subject Area
Electrical Engineering