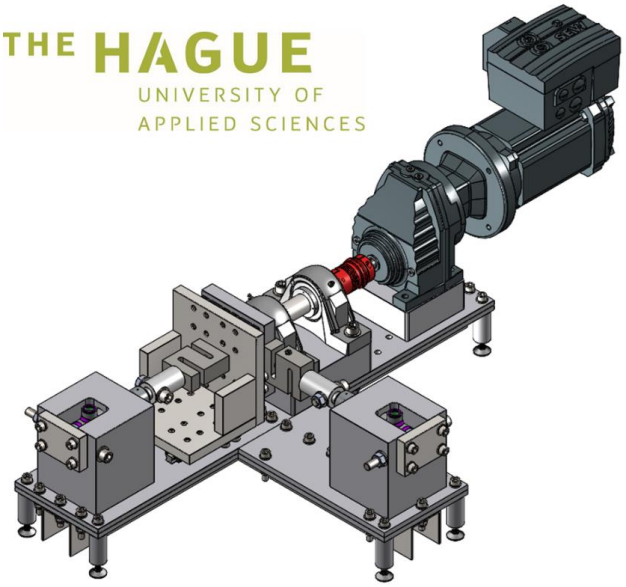
Test Set-up for Failure Data Generation of Rotating Machines



Introduction

A primary goal of PrimaVera is to validate algorithms for predictive maintenance. To achieve this, qualitatively good datasets are needed. Moreover, we are interested in developing a maintenance decision support tool for rotating machines. The Hague University of Applied Sciences (THUAS) is involved in PrimaVera to study which sensor types and locations are best suited for condition-based monitoring of bearings in rotating machines.

When it comes to collecting failure data of bearings in rotating machines, there are various types of sensors that can be used. The type of sensor will influence the diagnostic and prognostic algorithms that need to be used. The problem, however, is that it is unclear which type of sensor is best suited for condition monitoring in rotating machines, and at which location these sensors should be placed. In addition, there is limited access to good datasets that can be used for validating diagnostic and prognostic algorithms for these rotating machines.

To tackle the above-mentioned problems, the students of THUAS and ROC Mondriaan have designed a test set-up that can generate failure data of bearings in rotating machines.

Methods and approach

To get a better insight, the students of THUAS have visited other available test set-ups. Based on the requirements and a literature review, the students have suggested three concepts for the test set-up. Their concepts were discussed internally with the PrimaVera team at THUAS, and externally with other partners who are participating in PrimaVera. Based on the feedback from the experts in the field, the students have chosen a final concept. After creating a model in SolidWorks, the components of the set-up were purchased or produced in-house.

At this moment, all the components of the test set-up are made or delivered, and the students of ROC Mondriaan under supervision of Alieh Alipour and John Bolte are working on the assembly of the test set-up.

Having the test set-up ready, we will install various sensors to collect the failure data of the

bearings. Later on, we can compare the most suitable types of sensors that can be used in rotating machines when it comes to condition-based monitoring of bearings. In addition, our goal is to generate a good data set that can be used to validate diagnostic and prognostic algorithms.

Components of the test set-up

- **E-motor + controller**
  This component will provide the rotational forces on the bearing. The speed of the e-motor needs to be controlled with a frequency drive. This way, the test-setup can vary its speed from approximately 800 to 3000 RPM.

- **Gearbox**
  The gearbox will be attached to the electric motor. This way, the power of the motor can be transferred through the gearbox.

- **Linear guide (rail + carts)**
  The linear guides will allow some bending in the shaft when this occurs.

- **Torque limiter / flexible coupling**
  The torque limiter is a safety feature. The torque limiter will protect the most expensive part of the test-setup, i.e. electric motor.

- **Hydraulics system**
  The hydraulic system is responsible of applying force in the radial and axial direction of the bearing. By using hydraulics, a force up to 20,000 N can be applied to the bearings.

- **Support bearings**
  The support bearings have 2 functions. First of all, it holds the shaft in place. Under a lot of force, the shaft needs to be supported, while it is turning. Second of all, it prevents the axial and radial loads from reaching to the electric motor through the shaft.

- **Test bearing housing**
  The applied forces will be applied on the bearing through the bearing housing.

- **Mounting frame**
  The mounting frame is the frame that will be designed to hold the hydraulic cylinders in place. This component must be designed very strong to withstand high amounts of force.

- **Bottom plate**
  The bottom plate will be responsible for the mounting of all the components. Every component will be bolted down on the base plate.

- **Shaft**
  The shaft will be the most specific part in the design. It will connect the electric motor to the test bearing. Because the bearing needs to be mounted with particular tolerances, the shaft needs to be manufactured with very high precision.

Conclusion

At this moment, the test set-up is in the stage of realization. The students of ROC Mondriaan are currently working at THUAS to build the test set-up. As soon as the test set-up is ready, we will be able to install the selected sensors on the selected locations. With this set-up, we aim to develop a decision support tool, to determine the best sensor type and sensor location for condition-based monitoring of the bearings in rotating machines.

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