

Large dimension test bench for performance evaluation of hydrodynamic journal bearings

Jean BOUYER, PhD¹, Michel FILLON, PhD²

¹Pprime Institute, CNRS – University of Poitiers – ENSMA, France, jean.bouyer@univ-poitiers.fr, michel.fillon@univ-poitiers.fr

Abstract—The current work describes the design, construction and commissioning of a new test rig (named *Stribeck*) and presents the first results obtained.

Keywords—Journal bearing, hydrodynamic, experimental rig.

I. INTRODUCTION

Numerous experimental test rigs dedicated to hydrodynamic bearings already exist [1,2], but they are often designed as tools which aim is to validate numerical models and are thus not representative of real components operating in the industry. This work aims to present the first tests operated on the brand new test rig of our team from Pprime Institute.

II. PRESENTATION OF THE TEST RIG

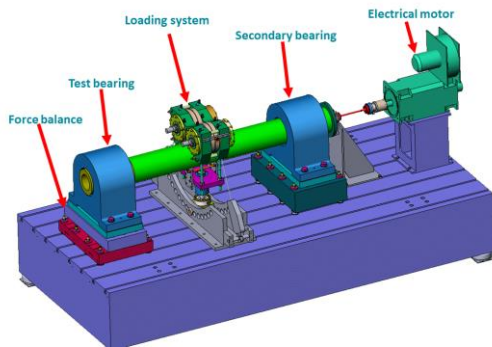


Fig. 1 General scheme of the test rig.

In its first configuration (Figs. 1 & 2), the test rig is composed of a 315 mm diameter shaft supported by two hydrodynamic bearings (lemon shape). The shaft is coupled to an electrical motor (4 000 rpm max; 230 kW). A radial load (500 kN max) is applied to the rotor according to two specifically designed cam rollers and a hydraulic jack. The direction of the load can also be changed ($\pm 45^\circ$ versus the vertical direction). All these parts are mounted on a rigid/heavy frame (35 tons) which vibration is isolated from the rest of the lab.

The original housing of the two bearings is modified in order to integrate thermocouples and pressure sensors (Fig. 3). One end of the shaft is also instrumented with pressure, temperature and displacement sensors. The front bearing is mounted on a force balance composed of four 3-components force sensors that are preloaded between two rigid plates. All these sensors allow to measure pressure and temperature at the film/bush and film/shaft interface, displacements of the shaft and friction torque.

Digital Object Identifier (DOI):

<http://dx.doi.org/10.18687/LACCEI2019.1.1.483>

ISBN: 978-0-9993443-6-1 ISSN: 2414-6390

17th LACCEI International Multi-Conference for Engineering, Education, and Technology: “Industry, Innovation, And Infrastructure for Sustainable Cities and Communities”, 24-26 July 2019, Jamaica.



Fig. 2 General view of the test rig.

A 1200 liters hydraulic unit feeds each bearing with oil at a flowrate up to 200 l/min and regulated temperature up to 80°C. First tests on a babbitted two-lobe journal bearing will be described and the performance of the bearing will be detailed in terms of pressure, temperature, torque and film thickness measurements. The presentation will point out the real capabilities of the test rig.



Fig. 3 View of a housing with its equipment

ACKNOWLEDGMENT

This work is supported by the Programme “Investissements d’Avenir” EQUIPEX “GAP” (réf. ANR-11-EQPX-0018).

REFERENCES

- [1] Cristea, A.F., Bouyer, J., Fillon, M. and Pascovici, M.D., "Pressure and Temperature Field Measurements of a Lightly Loaded Circumferential Groove Journal Bearing," *Tribology Transactions*, vol. 54, pp. 806-823, 2011.
- [2] Chatterton, S., Dang, P.V., Pennacchi, P., De Luca, A. and Flumian, F., "Experimental Evidences of a Cylindrical Journal Bearing Operating at Very Low Sommerfeld Numbers," *VIRM11*, Manchester, England, pp. 455-463.