Institut für Hydromechanik (IfH)
Prof. Dr.-Ing. Markus Uhlmann

Institut für Mechanik (IFM)
Prof. Dr.-Ing. Peter Betsch
Prof. Dr.-Ing. Thomas Seelig

Institut für Strömungsmechanik (ISTM)
Prof. Dr.-Ing. Bettina Frohnapfel

Institut für Technische Mechanik (ITM)
Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Alexander Fidlin
Prof. Dr.-Ing. Carsten Proppe
Prof. Dr.-Ing. Wolfgang Seemann

Kolloquium für Mechanik

Referent:	**Prof. Dr. Mihai ARGHIR** Institut PPRIME, UPR 3346, Université de Poitiers, France
Datum:	Do., 04.02.2016
Uhrzeit:	15:45-17:15 Uhr
Ort:	Geb. 10.81, HS 62 (R 153)
Titel:	**Theoretical and Experimental Analysis of Aerodynamic Foil Bearings**

Abstract

The aerodynamic foil bearing is a technology known since almost five decades that recently regained attention. The main cause for of the industrial interest in aerodynamic foil bearings is the tendency of increasing the power density of small rotating machines. At very high rotation speed the oil lubrication journal bearing encounters thermal problems and ball bearings have a limited life span. An additional advantage of the foil bearing is the fact that it is an oil-free technology compatible with restrictive ecological regulations.

The presentation introduces theoretical and experimental results obtained at the Pprime Institute of Université de Poitiers. The foil bearing has a compliant structure made of interacting bumps that are deformed by the pressure forces acting in the compressible lubricant (air) film. Due to their form, the bumps transform the radial deformation into friction forces that represent an important source of damping and enables the operation of the bearing at high rotation speeds. However, the coupling between aerodynamic, elastic and friction forces leads to a non-linear behavior of the rotor-bearing system that is currently under investigation.

An original non-linear model of the structure is presented. The model takes into account each bump of the compliant structure and predicts the individual unsteady friction forces. The presentation shows how this model was developed and how it predicts the transitions between stick-slip of bumps friction forces. Stability and unbalance responses of a Jeffcott rotor model are then presented and discussed from the standpoint of linear vs. non-linear approaches.

The second part of the presentation is dedicated to the experimental analyses of foil bearings. Two experimental approaches are described. The first is a component test rig with the rotor “floating” on the rotor and enables the measurement of start-up torque and speed and of dynamic coefficients. The second test rig consists of a rigid rotor supported on two identic foil bearings. The rotor is accelerated by an impulse turbine up to the desired speed and then measurements are performed during coast-down. The experimental results underline a typical non-linear signature of the rotor that is thoroughly discussed.

The third part presents the experimental results (start-up torque and speed, dynamic coefficients) obtained for thrust foil bearings on a component test rig.

The presentation ends with a discussion of the presenter’s point of view of the questions that need to be answered for rendering the technology of foil bearings accessible to industrial practitioners.

Alle Interessenten sind herzlich eingeladen.

Prof. Dr.-Ing. Wolfgang Seemann