Research Project: Pneumatic Friction

Simulation of Transient Seal Friction in Pneumatic Components

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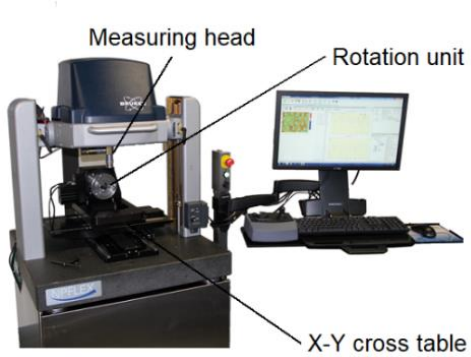
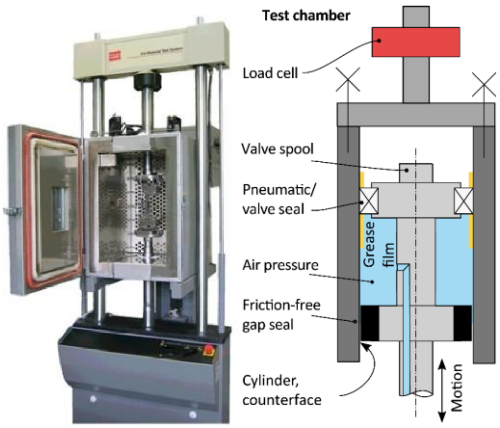


White light interferometer

Rheometer with temperature control unit (left) and cone plate test setup (right)



Hydropulser (left), test setup schematic sketch (right)

Motivation

In pneumatic components, the friction forces have a significant influence on the system due to relatively low operating pressures. The value of the friction forces depends on many tribological influencing parameters and is mostly unknown. The gap in knowledge about transient friction conditions leads to oversizing of systems, higher development and operating costs, and longer time-to-market.

Expected results

A physically motivated simulation model for transient behaviour of translational hydraulic seals was developed at the Institute for Fluid Power Drives and Systems (ifas) of RWTH Aachen University. In cooperation between the IMA of the University of Stuttgart and ifas, this physical model is further developed for the calculation of transient seal friction in pneumatic components by the example of a pneumatic valve.

Approach

At the IMA, a detailed experimental investigation of the sealing contact is carried out to ensure an advanced understanding of the system and to enable the validation of the simulation model. The following work steps are planned:

- Measurement and characterisation of the geometry and surface condition of the contact partners (sealing ring, valve housing and spool) with optical (e.g. white light interferometer) and tactile measuring devices.
- Determination of rheological properties of the lubricant (grease) with a rheometer.
- Development of an advanced tribological test method for valve seals based on a Hydropulser.
- Measurement of the friction in the sealing contact to validate the simulation model.

Simultaneously, the simulation model is being further developed and validated at ifas.

The project "Simulation of transient seal friction in pneumatic components" is funded by the VDMA Fluid Technology Research Fund.