

# Nano and micro Tribology

## Research areas

- Tribology – biotribology, nanotribology, surface texturing, starved lubrication, speed and load changes in elastohydrodynamic contact, oil degradation measurements, and transient behaviour of elastohydrodynamic contact
- Friction and wear properties of surface layers and coatings
- Experimental study of real roughness attenuation in rolling/sliding concentrated contacts
- Mechanical Degradation of the Liquid in an Operating EHL Contact

## History of the lab

The Tribology Laboratory has history of more than 20 years and is recognized as a distinguished lab in specific field. A new experimental technique for the study of thin lubricant films by means of colorimetric interferometry has been developed here. This technique is able to provide real time data for thin lubricant film shape studies. The essential part of the lab is represented by an experimental apparatus for the study of elastohydrodynamic lubricant films based on a computer controlled dynamic Fizeau interferometer. Recently, a 3D optical profilometer based on phase shifting interferometry has been incorporated to measure in-situ initial undeformed real surface topography. Latest results published in scientific journals have proved the combination of thin film colorimetric interferometry with phase shifting interferometry to be one of the most powerful tools for the investigation of mixed lubrication of real surfaces in situ.

This laboratory enables practice verification experiments to be performed in precisely known conditions and ensure true and repeatable results. About 80 percent of machines are disabled as a result of the damage of thin surface layers caused, among other things, by the local breakdown of elastohydrodynamic lubrication films. It is in the close relation to the lubricant capability to create coherent protective film. It is mostly characterised by the film thickness dependence on operation conditions (speed, load, temperature etc.) and rubbing surfaces topography.

## The key equipment

### *Optical Tribometer*

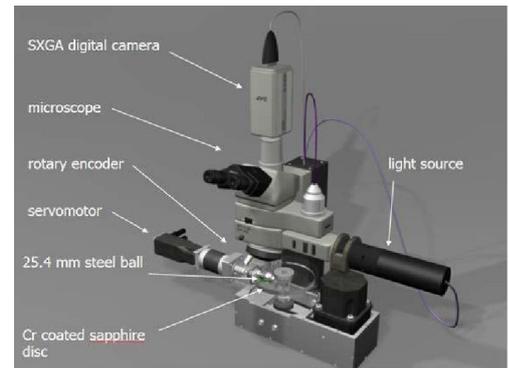
Film thickness and friction measurements for highly loaded contacts between machine components. It can be used for the evaluation of lubricants and additives effects, effect of contamination, comparison of various types of lubricants etc.

Specifications:

Contact load: 5 – 125 N Traction force:

0.05-30 N Rolling speed: 0.005 - 4 m/s

Temperature: ambient to 150 °C ±1°C



### *Phantom v710*

High-Speed Camera

The high speed camera provides a record of the process or object that is moving very fast or when the process leads to very rapid changes.

Specifications:

Max speed at full resolution of 1280 x 800 is 7530 fps, minimum exposure

1 μs (optional 300 ns), 20 μm pixel size.



### *Bruker ContourGT-X8*

Non-Contact 3D Optical Profiler

The ContourGT-X8 provides the highest speed, accuracy, and range for 3D, non-contact surface measurement of ophthalmic lenses, medical devices and tools, high-brightness LEDs, semiconductor devices, through-silicon vias and trenches, solar cells, and precision machined parts.

Specifications:

Magnifications from 0.5X to 200X enable characterization of a wide range of surface shapes and textures, sub-angstrom-to-millimeter vertical range.



**MTM (Mini Traction Machine)**

## Mini Traction Machine

The Mini Traction Machine is a flexible general purpose instrument for measuring the frictional properties of lubricated and unlubricated contacts under a wide range of rolling and sliding conditions.

## Specifications:

Load from 0 to 75 N, contact pressure 0 - 3.1 GPa, velocity up to 4 m/s, slide-to-roll ratio from 0 to 100%, the measuring temperature up to 150 °C, the volume of test sample 35 ml (optionally 10 ml).

**Contact person**

prof. Ing. Ivan Křupka, Ph.D.

Email: [ivan.krupka@ceitec.vutbr.cz](mailto:ivan.krupka@ceitec.vutbr.cz)

Phone: +420541142723