

Činnosti na ÚK

2022-2024

Ing. **Petr Šperka**, PhD.

ÚSTAV KONSTRUOVÁNÍ
Fakulta strojního inženýrství
VUT v Brně

Brno, 17. 04. 2024



ÚSTAV
KONSTRUOVÁNÍ

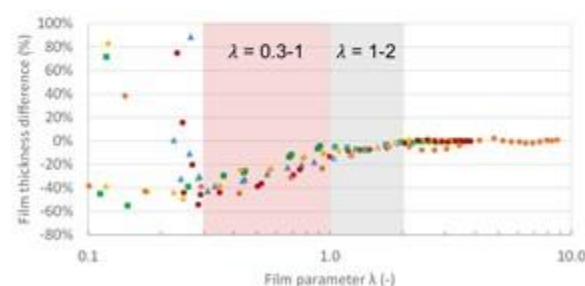
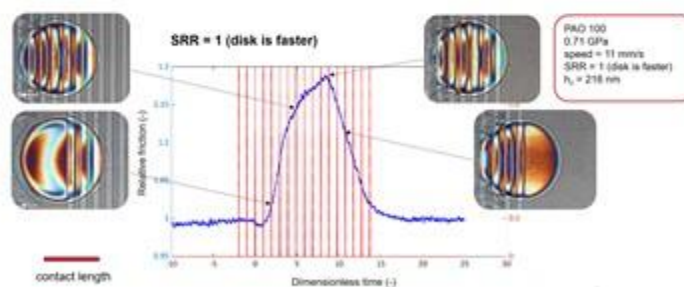
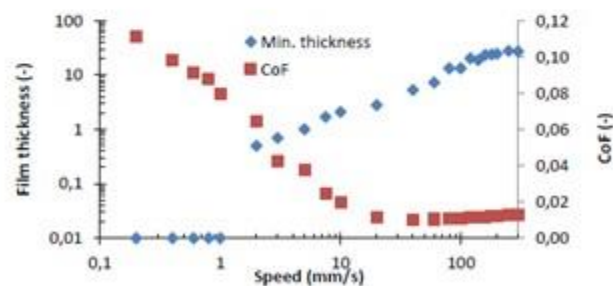
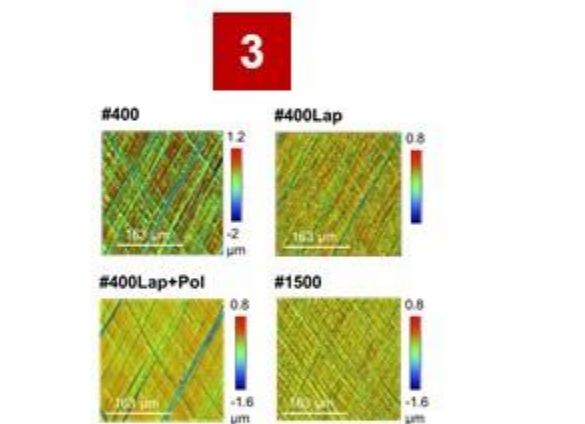
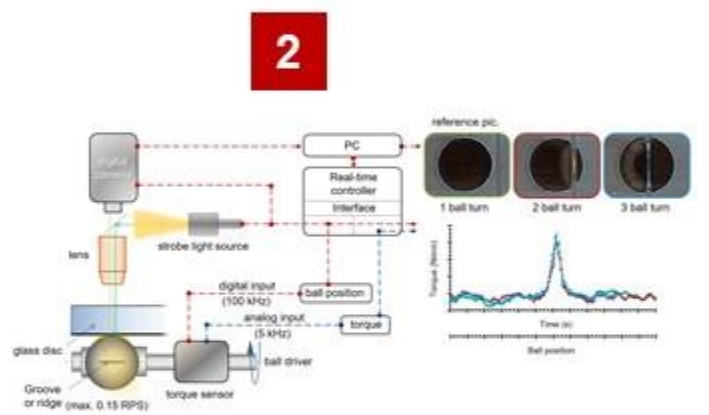
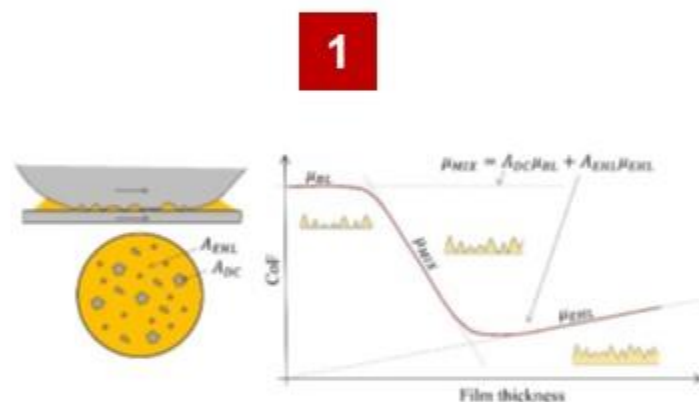
Contents

- **Projects**
- **Contractual research**
- **Other cooperations**
- **Teaching**

GAČR 2021-2023 Thin films at transition to mixed regime

Rheological properties of thin lubricating films in point contacts at transition to mixed lubrication

- Cooperation: J. Frýza

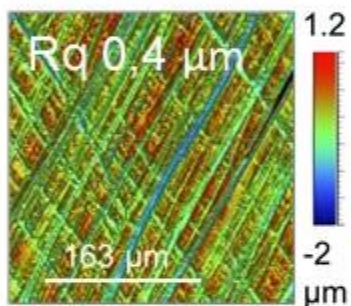


GAČR 2021-2023 Thin films at transition to mixed regime

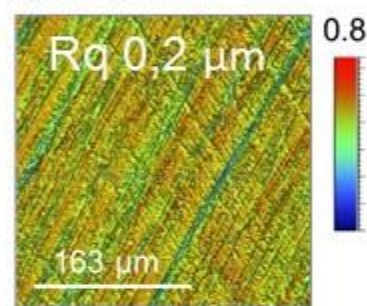
Rheological properties of thin lubricating films in point contacts at transition to mixed lubrication

3

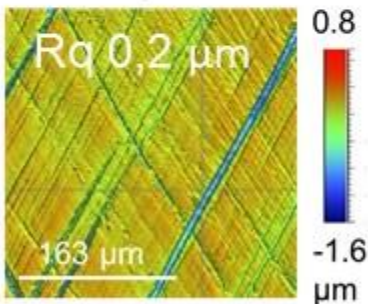
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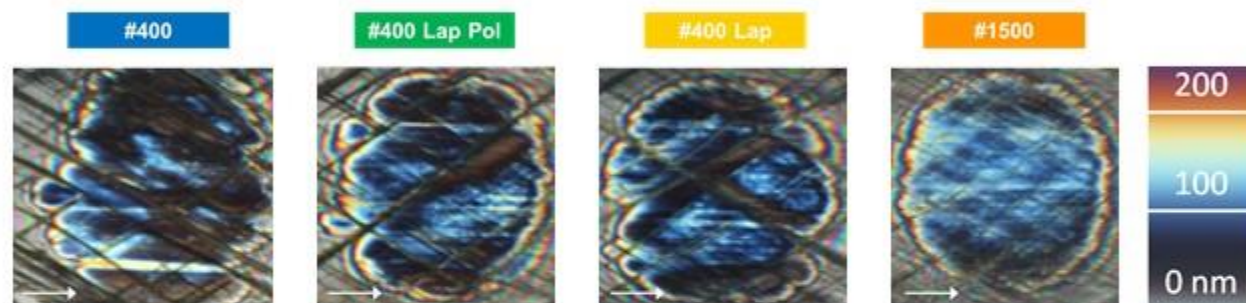
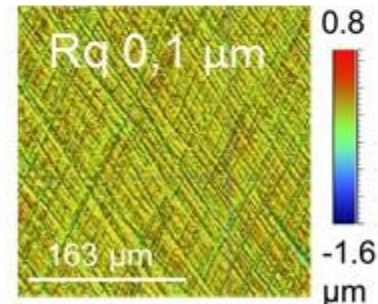
#400Lap



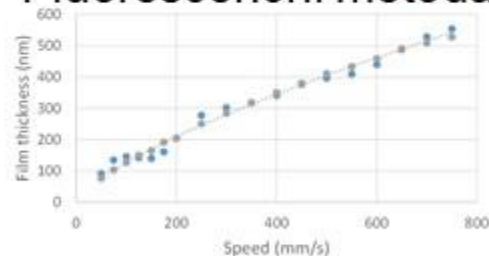
#400Lap+Pol



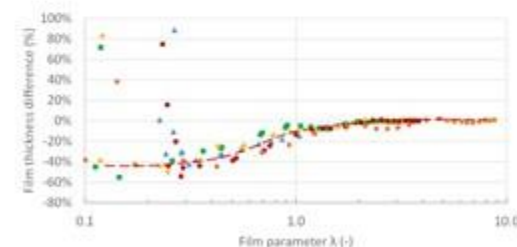
#1500



Fluorescenční metoda

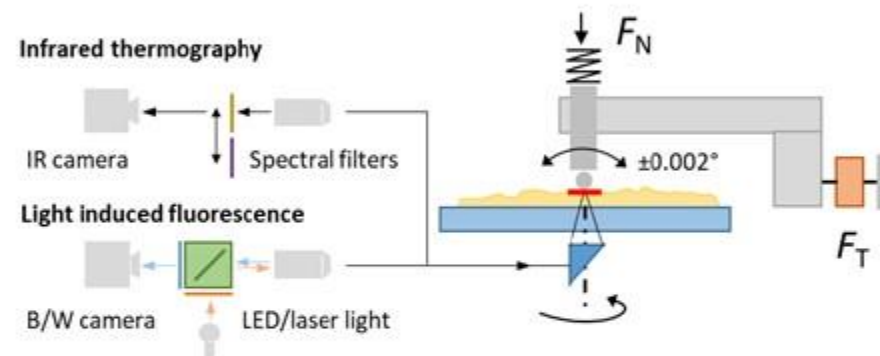
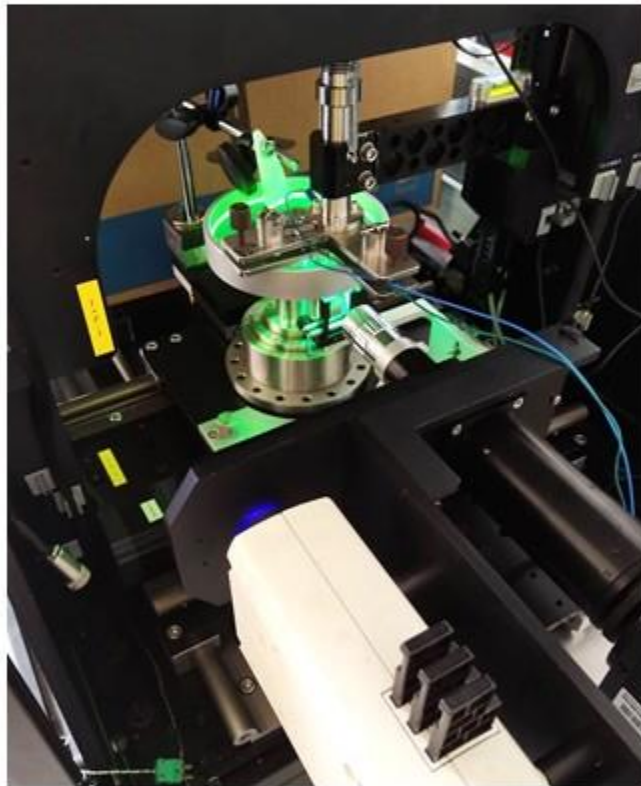


- Thin film colorimetric interferometry
- Light induced fluorescence



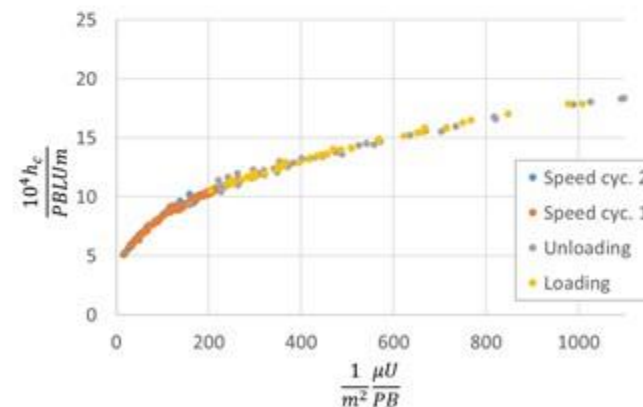
Thermohydrodynamic effects of boundary slip and surface texturing in sliding contacts

- Cooperation: ZČU Plzeň, M. Omasta, M. Ranuša

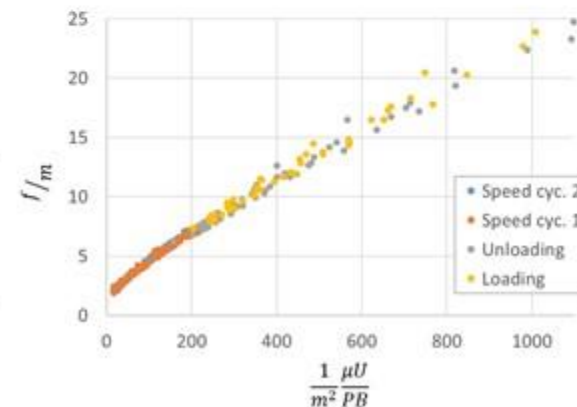


1. Surface texturing
2. Thermal effects
3. Surface roughness
4. Partial slip at interface

Central film thickness



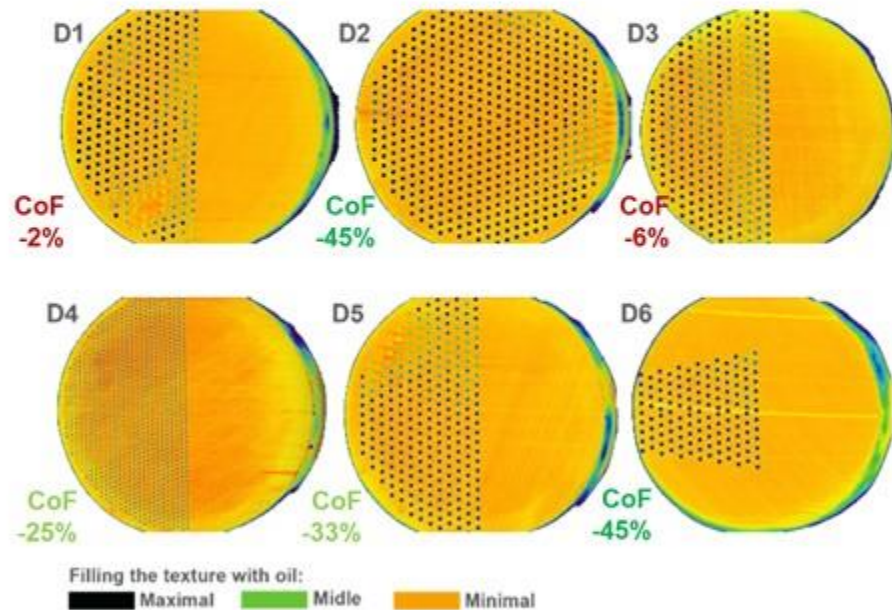
Coefficient of friction



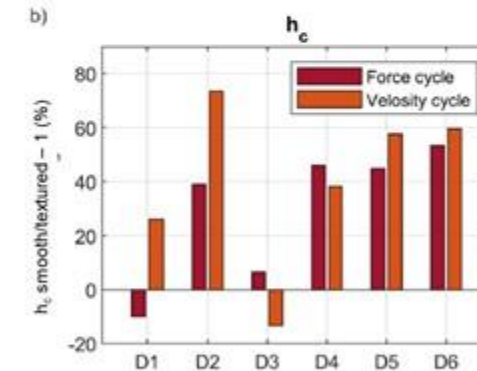
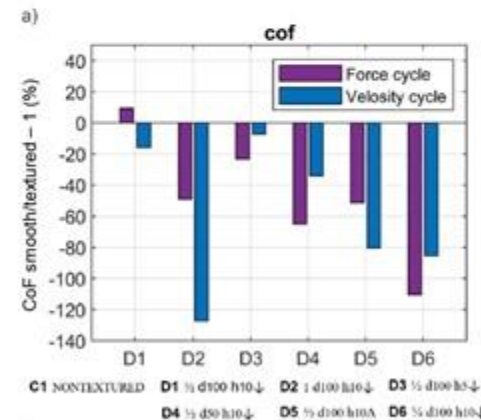
Thermohydrodynamic effects of boundary slip and surface texturing in sliding contacts

- Cooperation: J. Knotek

Cavitation (average filling)



Parallel surfaces

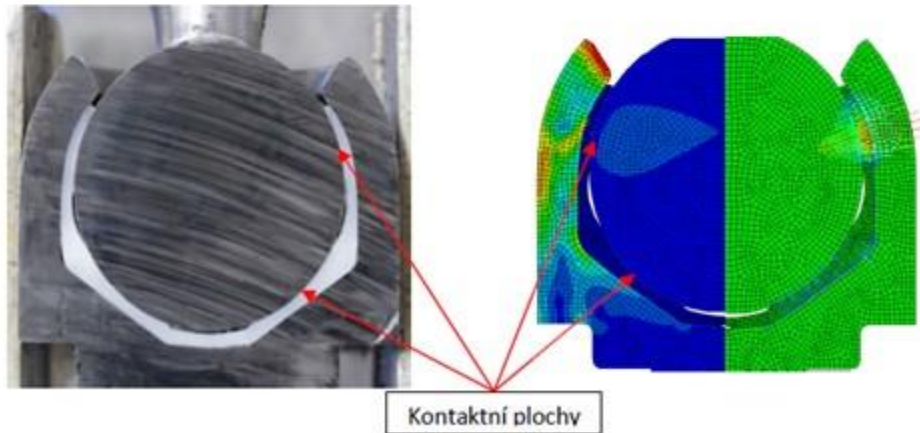
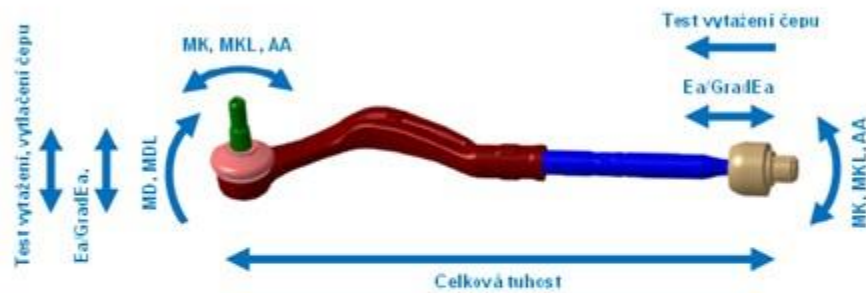


TAČR 2024-2026 ball joints for automotive



Development of a ball joint with low breakaway moments and high wear resistance

Cooperation: J. Frýza, V. Polnický



WP1 POM-Steel Tribology

- Modelling and analysis of static friction spikes



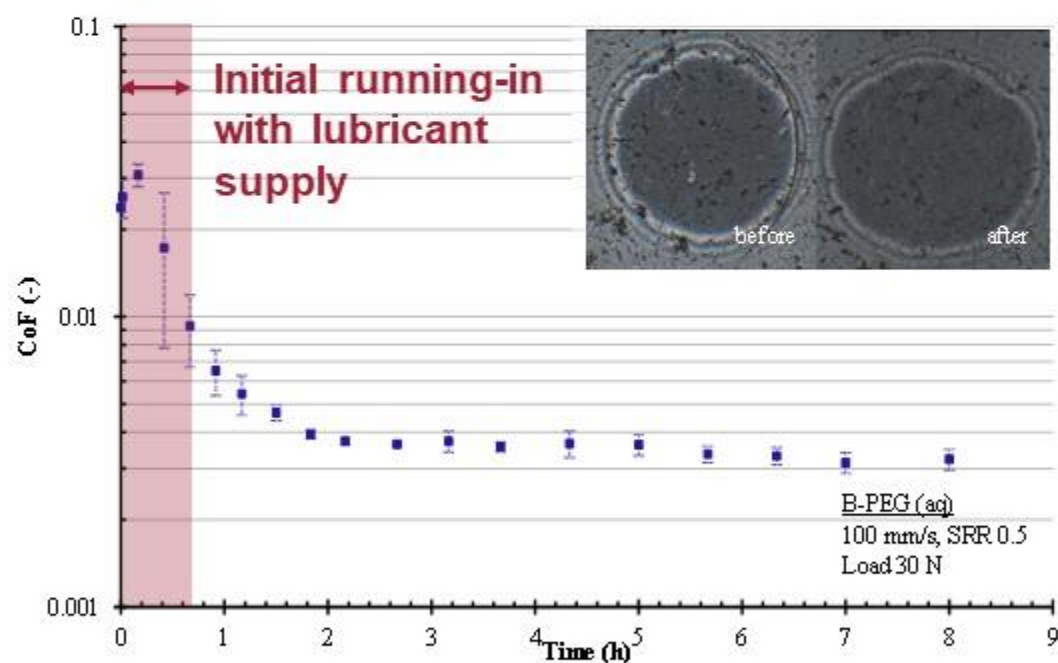
WP2 Grease distribution in ball joint

- Visualization and analysis of grease distribution in ball joints

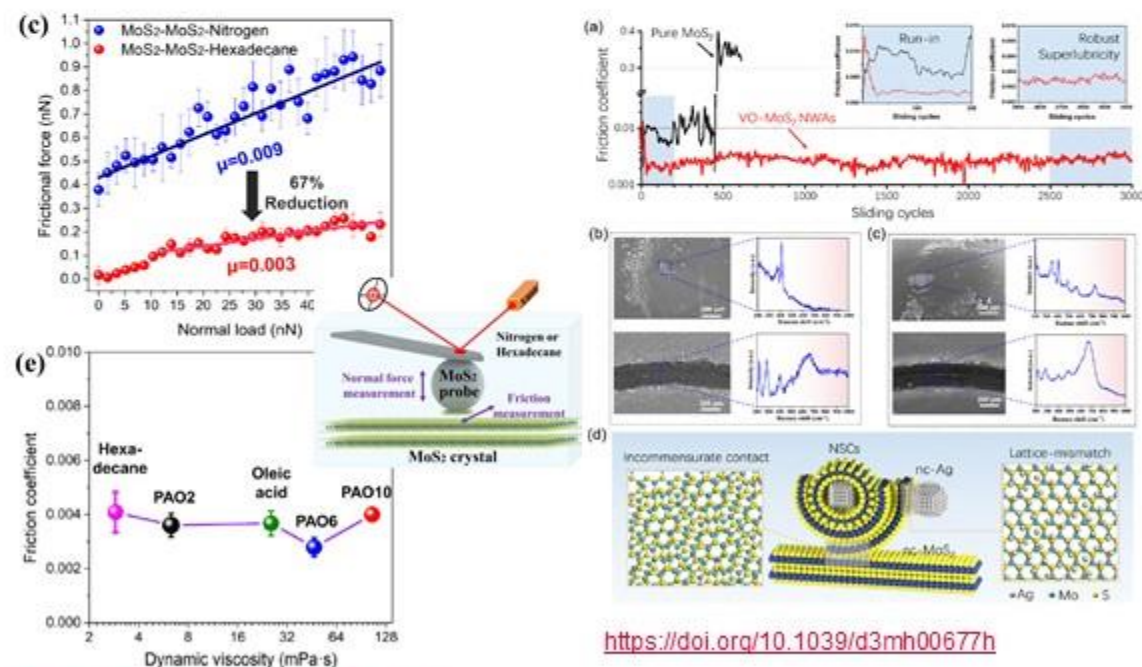
WP A2.2 Bio-inspired lubrication systems with potential for industrial applications

- Cooperation: J. Macák (CEITEC), T. Poláček, Č. Šváb, L. Daněk

Lubrication mechanisms of water miscible fluids



Superlubricity of coated solids and lubricants with nanoparticles (2D material: MoS₂, hBN, MXENE)



<https://doi.org/10.1039/d3mh00677h>

<https://doi.org/10.1021/acsami.2c00693>

Planned investments

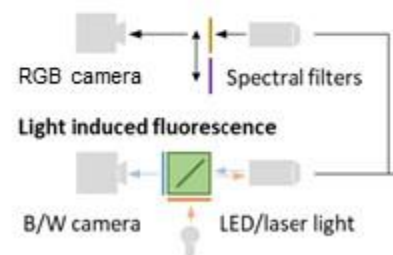
Micro tribometer

- OPJAK MEBioSys

Load resolution: $1,2 \mu\text{N}$
Load range: 20 N
Friction resolution: $0,28 \mu\text{N}$
Friction range: 1,8 N

Be able combine device
with optical methods

Interferometry



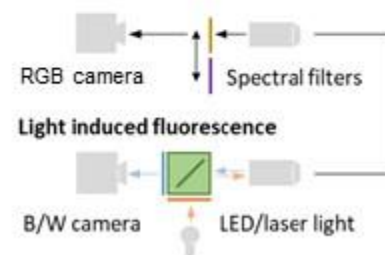
Rheometer

- ERDF

Minimum torque: 1 nNm
Minimum rotation: 10^{-7} rad/s
Normal force range: 50 N
N. force sensitivity: 0,01 N

Be able combine device
with optical methods

Interferometry



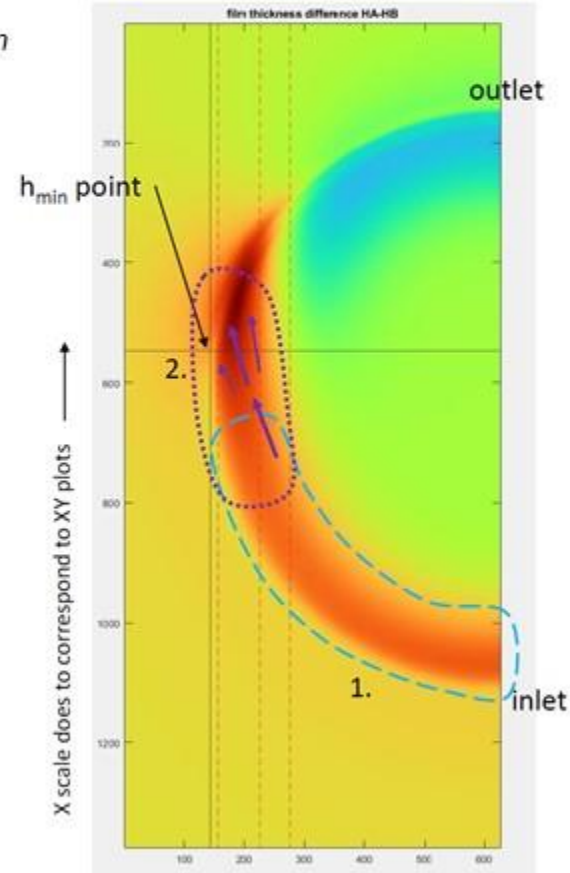
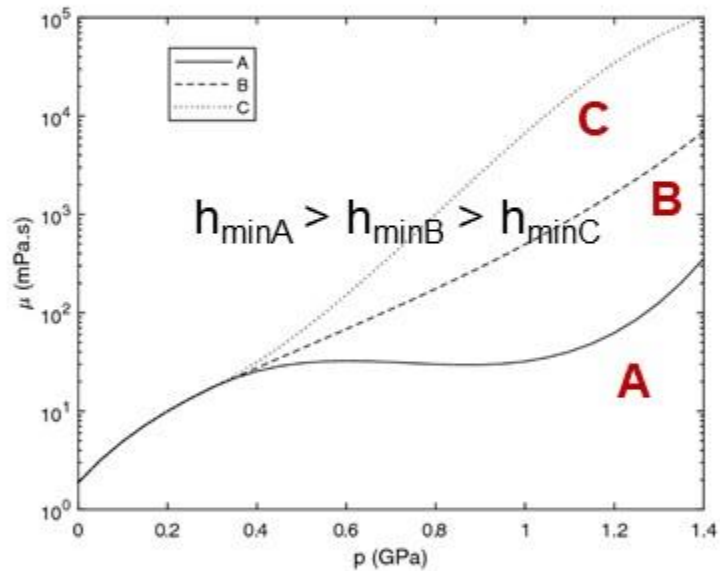
Optics Plate
Accessory (OPA)



Cooperation

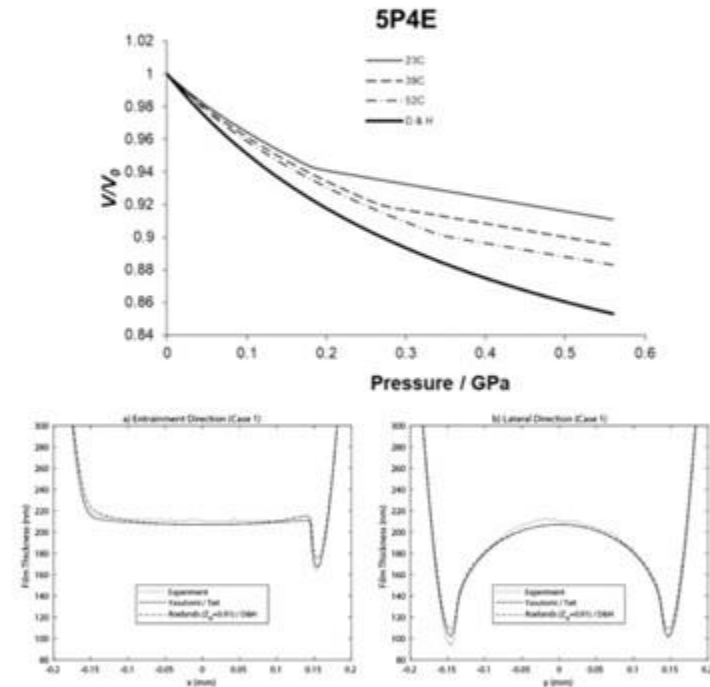
Minimum film thickness in EHL contact 2023-2024

- Role of in-contact rheology on h_{min}



<https://doi.org/10.1007/s11249-023-01771-y>

- Role of glass transition on h_{min}



<https://doi.org/10.1016/j.triboint.2023.109061>

Teaching activities

Bachelor's degree

- **5KS** **Konstruování strojů – strojní součásti**
- **0KS** **Vybrané kapitoly z konstruování strojů - strojní součásti**
- **ZP6** **Projekt - výpočtové modelování**

Master's degree

- **ZTR** **Tribologie**
- **ZKP a ZIP** **Inženýrský a konstrukční projekt**

Doctoral's degree

- **9EHD** **Pokročilá tribologie**
- **9EXT** **Experimentální metody v tribologii**

Supervision of Bachelor, Master and PhD thesis

ZP6 Projekt - výpočtové modelování (od LS 2025)

- Basic theory behind theoretical modelling, experiments, analyses
- Team solving of real problems
- Solutions will be compared to experiments
- Problems from areas: engineering mechanics (kinematics, dynamics, elasticity and strength)

Competencies

- Analyse real system and make computational model
- Manage simplifications/assumptions
- Estimate uncertainties and calculation errors

Main goals

- Students active approach, fun to study

Hobbies



DĚKUJI VÁM ZA POZORNOST

Ing. Petr Šperka, PhD.

petr.sperka@vut.cz



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