

Činnosti na ÚK

Tribology group - section lubrication fundamentals

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Contents

- **Current position**
- **Finished and ongoing work** (Contractual research, basic research and teaching)
- **Current state** (What are our strong and weak places? Teach from our mistakes.)
- **Goals and roadmap for future** (How we should shape us? What to focus on?)

Current position

Current position: assistant professor

Last seminar presentation: April 2014

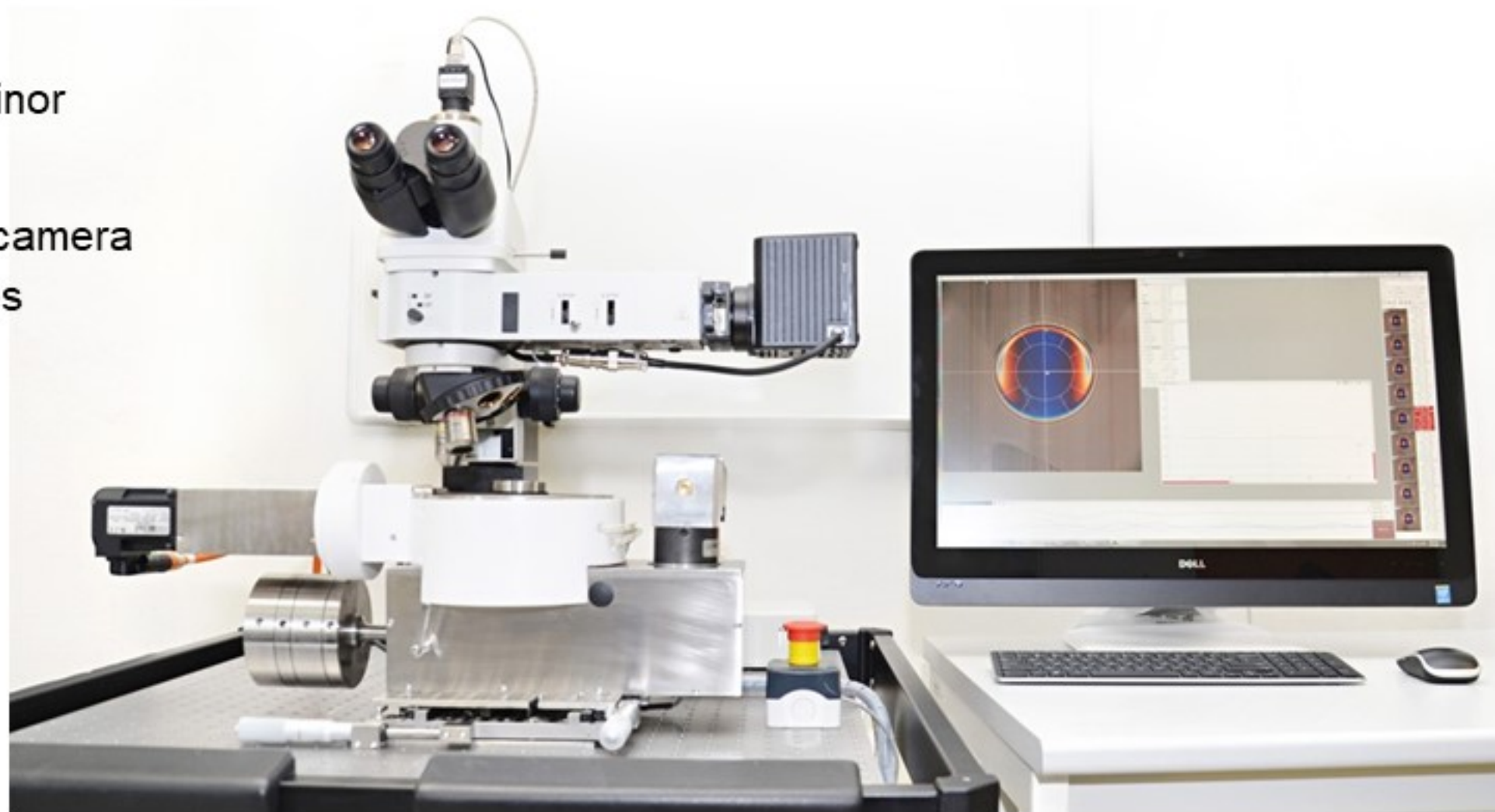
Responsibility for one section within Tribology group – Lubrication fundamentals

Vedoucí sekce			
Docent/ Odborný asistent		 	
Doktorand		  	   
Výzkumný pracovník		 	

Design, production and delivery of unique devices

2016 Redesigned optical tribometer for Japan

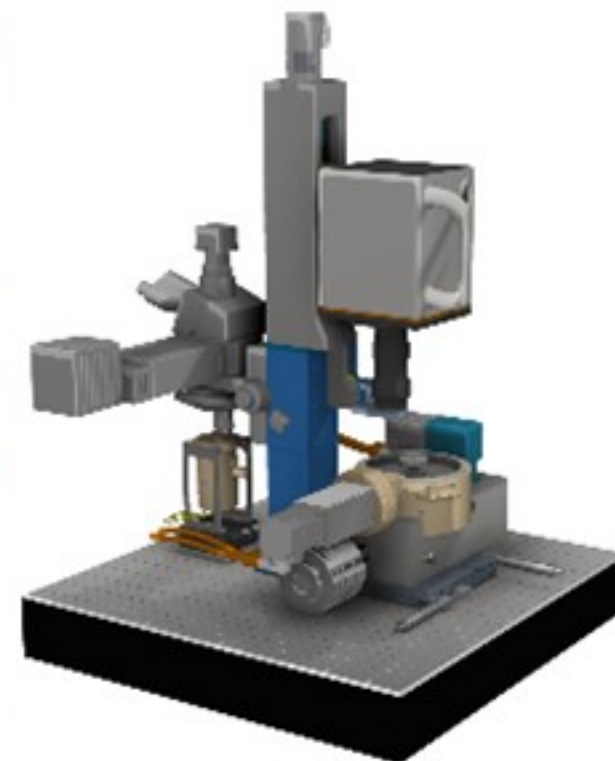
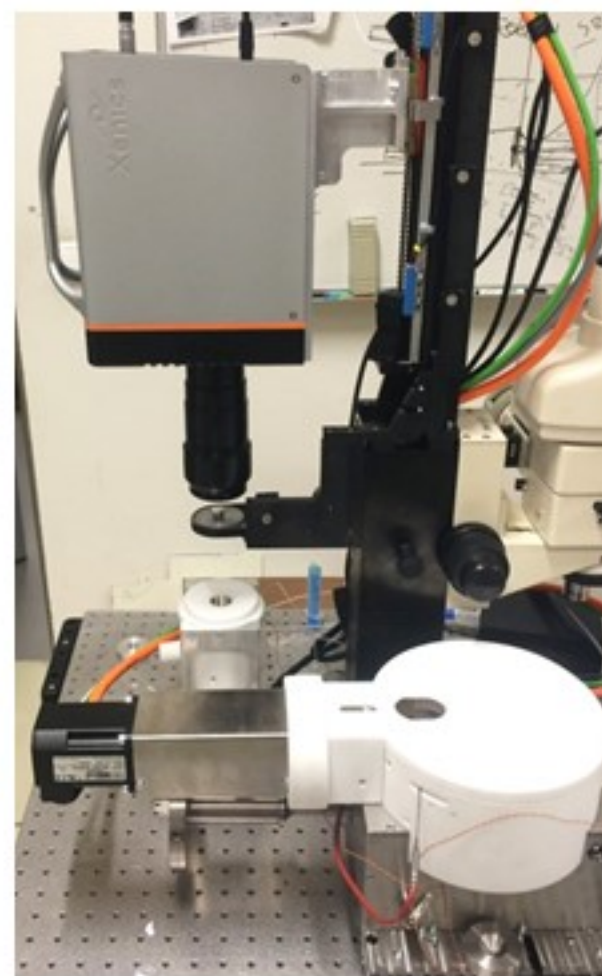
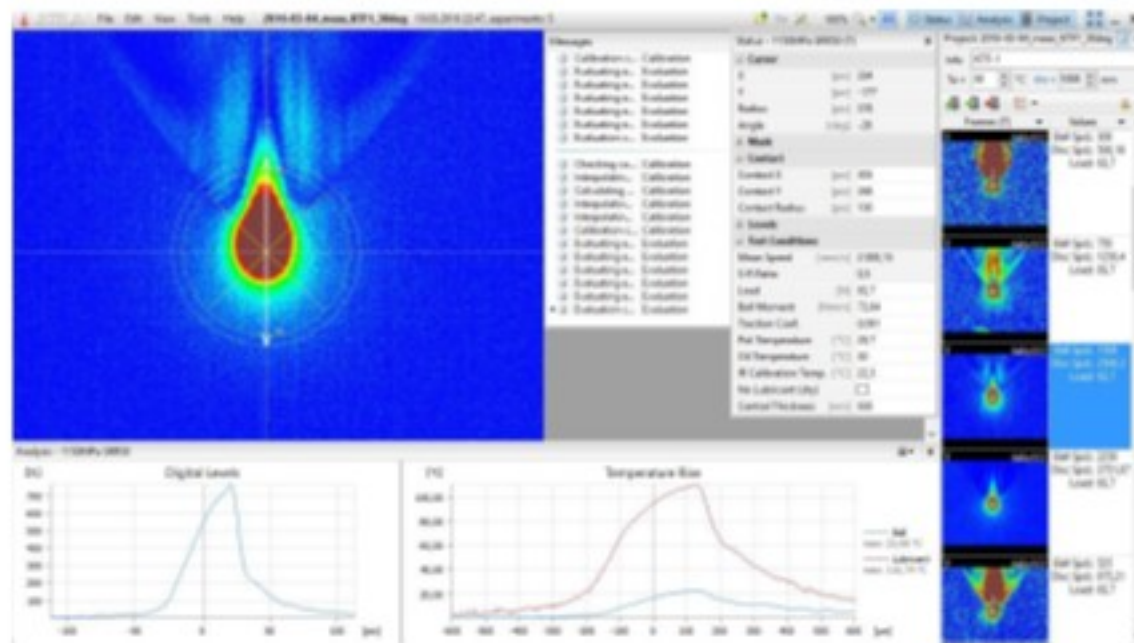
- Cooperation: David Košťál, Radek a Petr Poliščuk
- 7 months project
- List of 12 major and 27 minor improvements
- New software for rig and camera + improvements on Achilles (newly on Windows 8)



Design, production and delivery of unique devices

2017 Extension of the Japan optical tribometer by IR thermography

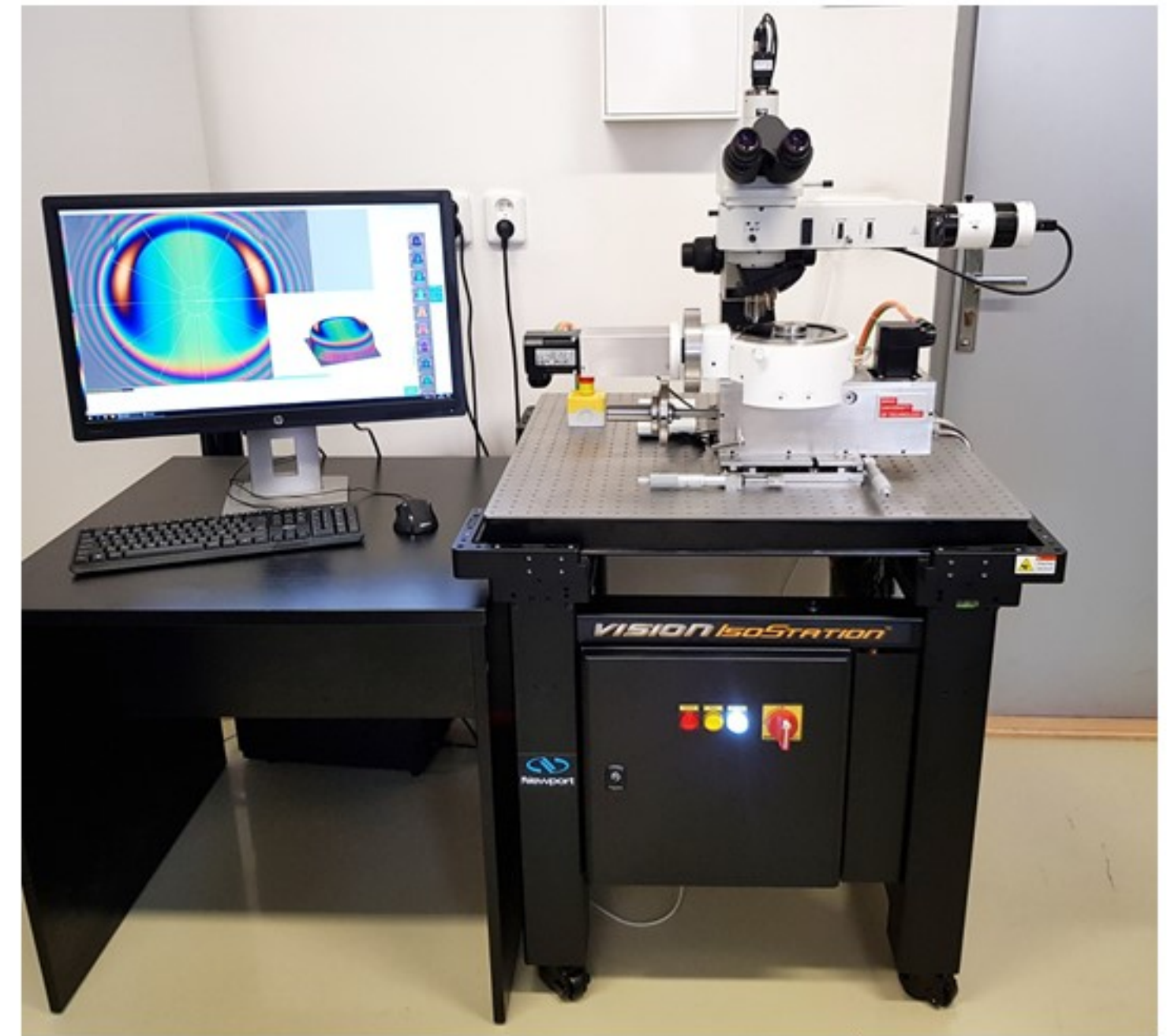
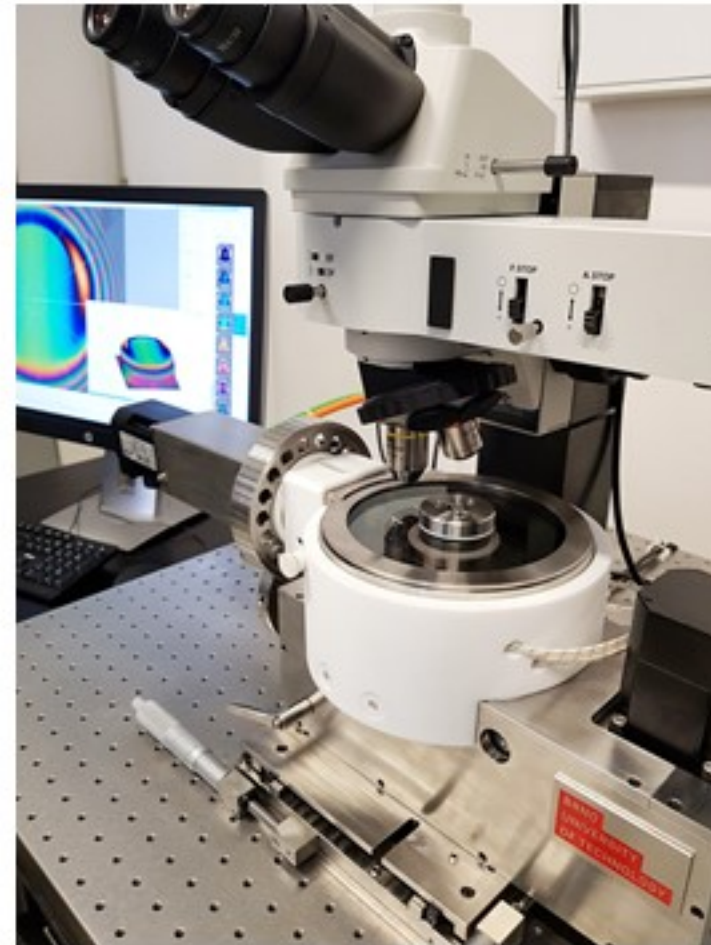
- Cooperation: David Košťál, Radek a Petr Poliščuk
- 7 months project
- Procurement of IR camera
- Automatisation and implementation of calibration and measurement
- New software ATILA



Design, production and delivery of unique devices

2018 Optical tribometer for Germany

- Cooperation: David Košťál, Vojtěch Polnický, Radek a Petr Poliščuk
- 5(7) months project
- 5 technical improvements



Design, production and delivery of unique devices

2015-2016 Device for spraying of polymer coating on journal bearings

- Cooperation: master student and Radek Poliščuk
- 13 months project (delivery after 10 months)



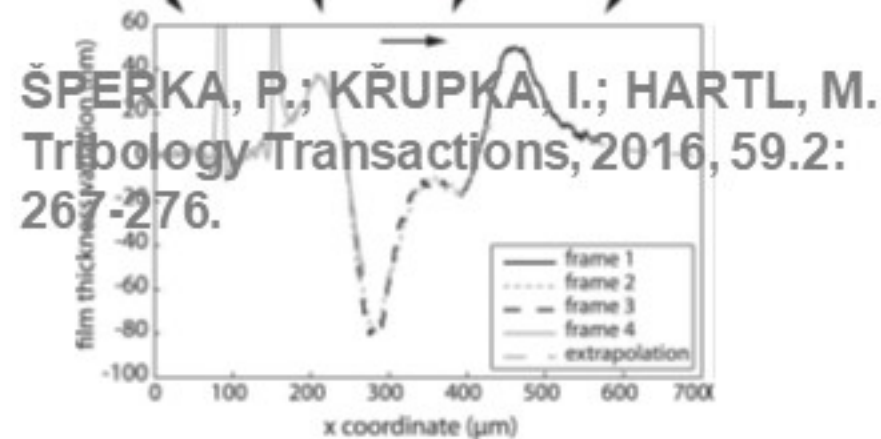
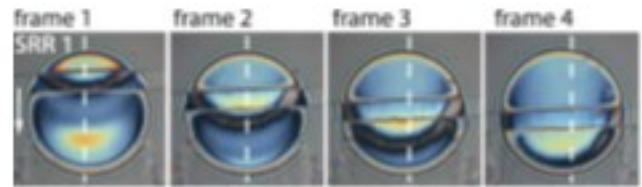
2016 Sanding device modification for automated pre-processing of journal bearing surface

- Cooperation: David Košťál and Radek Poliščuk
- 8 months project (delivery after 5 months)



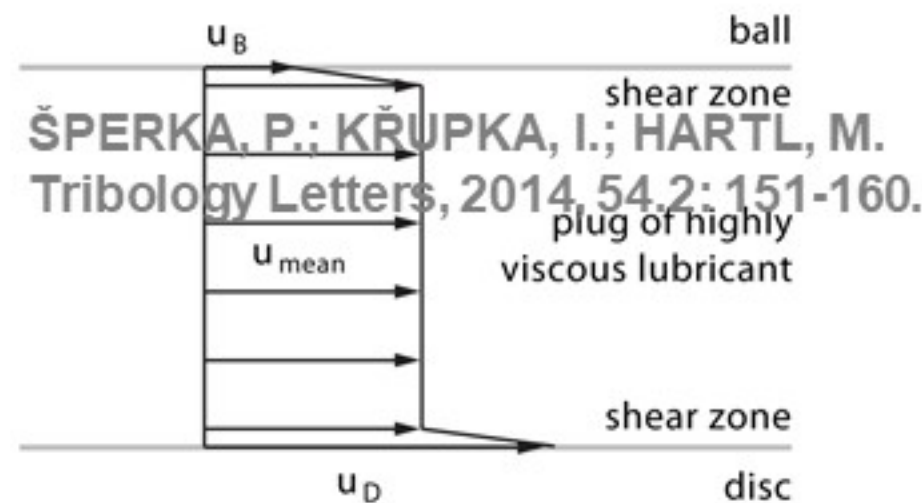
My research way in recent five years

2014 Detail study of roughness feature effects in a rolling-sliding contact

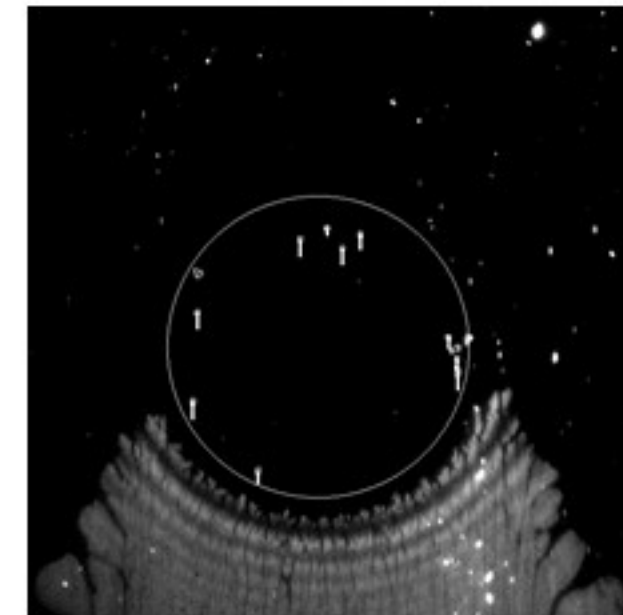


2014 Publication of our first paper on plug flow in an EHL contact

- Additional six measurements were published and presented in following years.
- Now, there are at least four different experiments.



2014-now Development of method for fluid flow measurement



Particle tracking

Speed profile

Captain Alfred E. Hunt
Award by STLE in 2017



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Recent research activities

Plastic gears

- Cooperation: master student
- Interferometry film thickness results from elliptical contact between PMMA and steel

Plain bearing contact

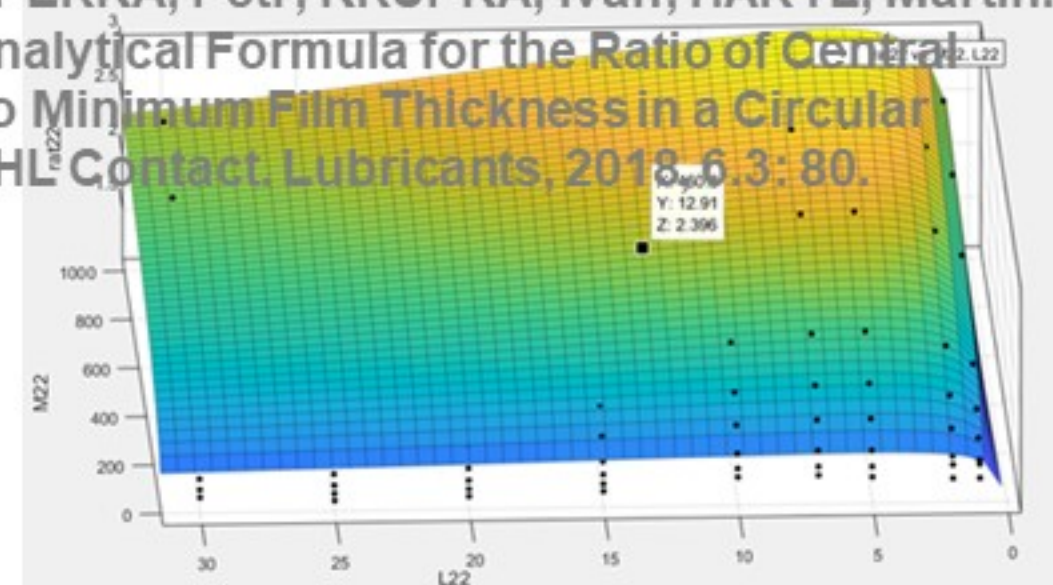
- Cooperation: master student
- In-situ friction measurement and optical observation of textured surface

Minimum film thickness

- New regression formula of numerical simulation results (set of 270 conditions)
- Ratio of central to minimum film thickness
- Average RMSE 0.036

$$h_c/h_{\min} = 1 + 0.1 \cdot \alpha_{\text{film}}^{0.128} \cdot M^{0.38} - \sqrt{M} \left[\frac{\alpha_{\text{film}}^{0.2} \cdot \ln(L) - 3}{22.7} \right]^2$$

SPERKA, Petr; KRUPKA, Ivan; HARTL, Martin. Analytical Formula for the Ratio of Central to Minimum Film Thickness in a Circular EHL Contact. *Lubricants*, 2018, 6.3: 80.



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Contractual research 2018

SHM

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Nanotech

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ON Semiconductors

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Development of High pressure viscometer

2013 Diploma thesis

- Master student (Lukáš Skalický)



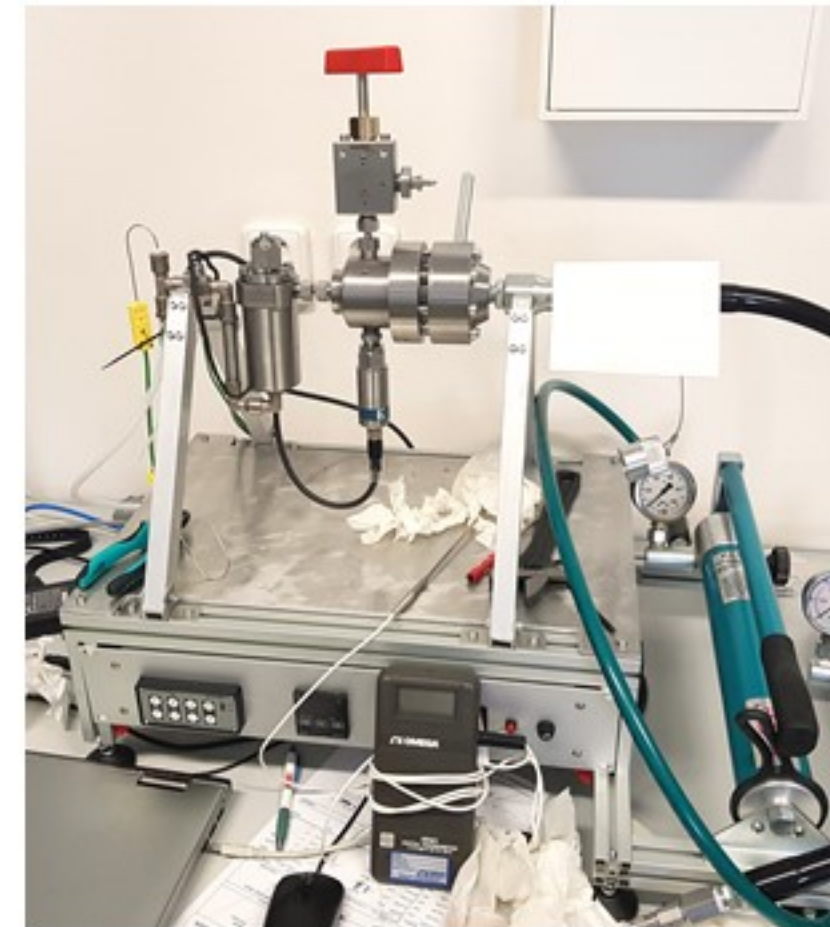
2016 Student project (not realized)

- Supervision: David Košťál



2018 Scott Bair inspired design (working)

- Cooperation: Student project + V. Polnický



TACR Project of rotary actuator

2017-2019 Rotary actuator for antenna pointing applications

Honeywell



- Cooperation: David Košťál
- Lubrication design of rolling bearings, component level testing (design of rig) of the bearings, general tribology expertise
- Tested: MAC based grease and MoS₂ lubrication under small amplitude reciprocating cycling

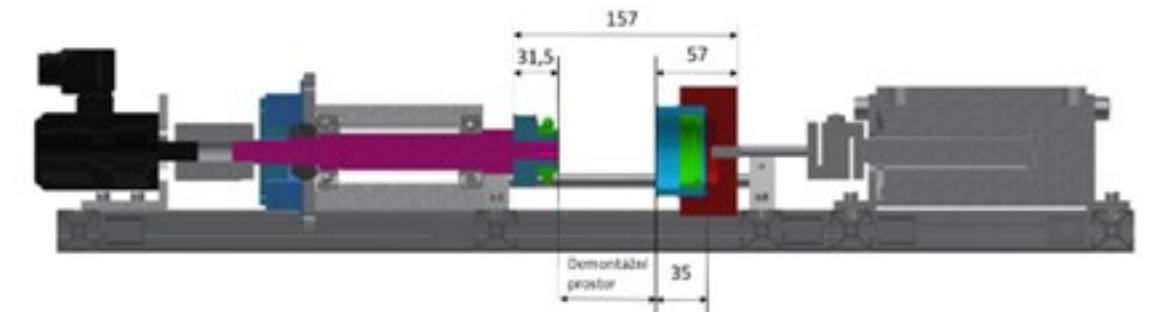
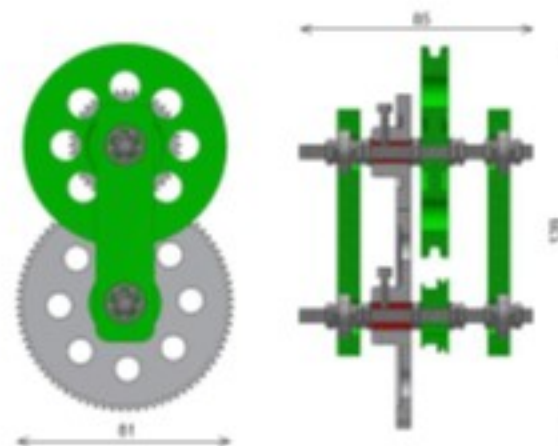
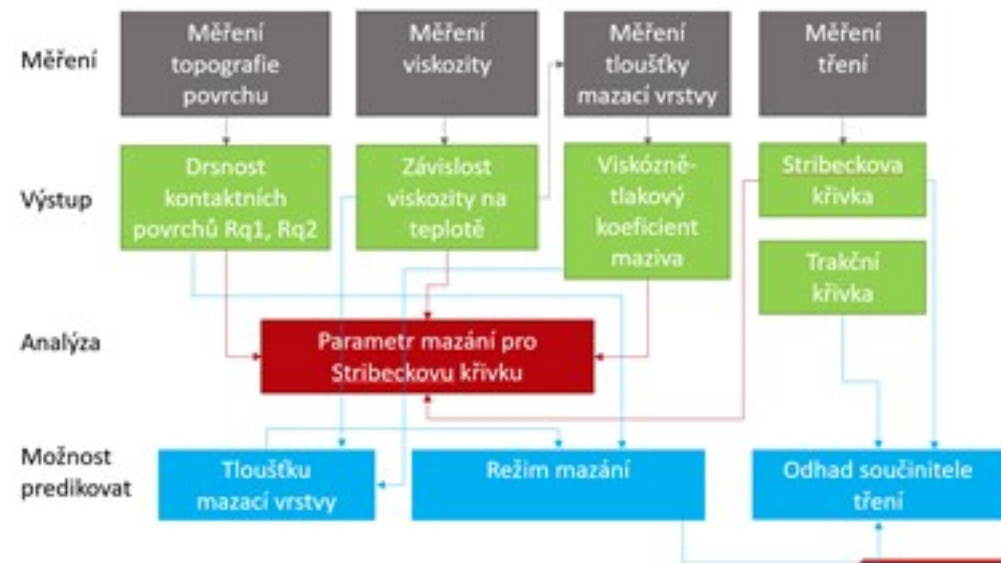
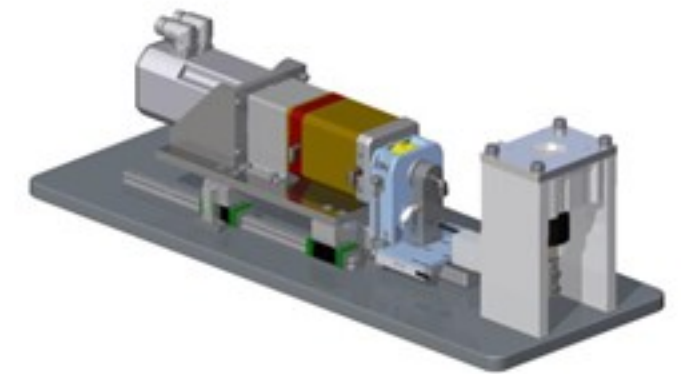
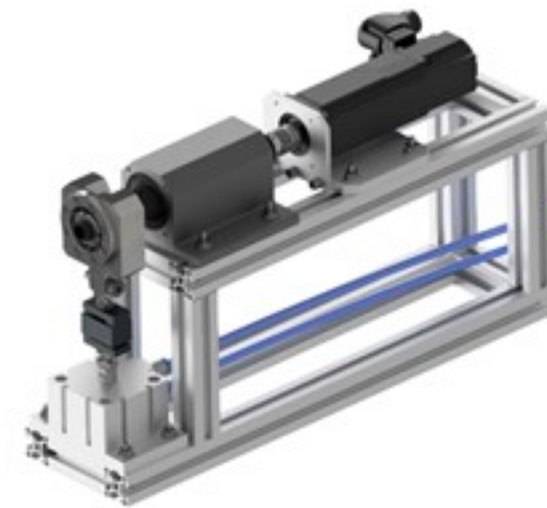
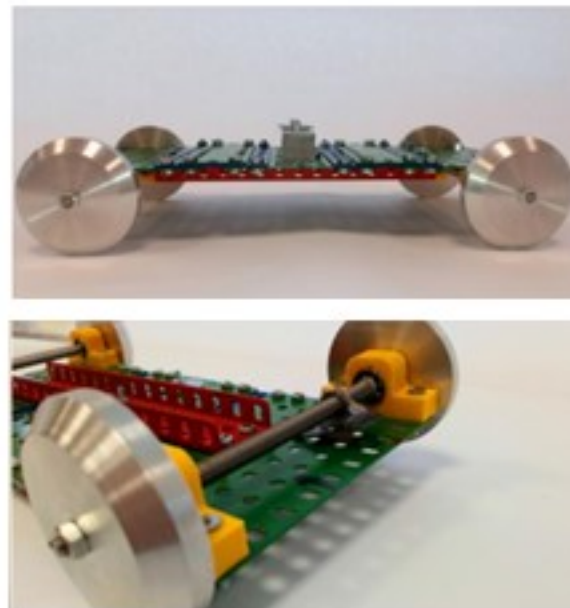
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Teaching activities

- 9EHD Elastohydrodynamika
- 5KS Konstruování strojů – strojní součásti
- ZTR a ZKR Tribologie
- ZKP a ZIP Inženýrský a konstrukční projekt



Overall research outputs

Publications

	2014	2015	2016	2017	2018
Jimp	3	3	8	3	5
Q1 Journal	0	1	4	2	3
Scopus	1	2	1	3	3
Written by me	2	0	7	1	1
International presentations	5	4	3	5	5

Planned publications 2019 (complete section)

Jimp 7
Scopus 3

Projects

	2018	2019
GAČR	2.5	2.5
TAČR	1	1
NCK		1
Other	3	1
R&D FTE	4.72	5.05
FTE/project	0.73	0.92

Therefore, it requires to be efficient and split the work equally.

Analysis of current state

Accomplishments

- Cutting edge research
- Design and deliver unique devices
- Group growth focused on outputs

Main global challenges

- Sustainability (financing and workload)
- System of working (management, good atmosphere and team working)
- Synergy (teaching, workload, projects)
- Involvement of good people

Space for improvements

- Better team working and management
- Rough planning of workload
- Synchronization of PhD study with project
- Conflict of interest between teaching and research activities
- Transfer of simple job (purchase administration etc.) to support staff

Goals for future and roadmap

Basic research

- Provide cutting edge experiments in lubrication fundamentals
 - Development new methods (HPV, fluorescence)
- Concentrated focus on specific problems
 - Starvation and grease lubrication of rolling bearing
 - Surface roughness effects on film thickness and friction
 - Closely related fields (lubricant rheology, plastic contacts, soft contacts, plain bearings)
- Publish in high quality journals (Q1), adjust planned papers on project accordingly

Practical and Contractual research

- Building universal competences for general tribology problems
- Focus on machine part or technology interesting for business (≥ 2020)
- Maintain present project partners (offer possible themes for cooperation)
- Maintain present (reasonable) effort on small contractual research
- Consider organizing tribology workshop for companies (≥ 2020)

Delivery of devices

- Focus on projects with proper added value and consider gained experience

DĚKUJI VÁM ZA POZORNOST

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