

**Pavel Mazal**

# **Overview of activities**

ÚSTAV KONSTRUOVÁNÍ  
Fakulta strojního inženýrství  
VUT v Brně

Brno 15. 04. 2020



**ÚSTAV  
KONSTRUOVÁNÍ**

# CONTENT

- **Sub-division overview**
- **Teaching**
  - **Bachelors and master's thesis, doctoral studies**
- **Research activities**
  - **Projects TA CR**
  - **Projects MPO**
  - **Others**
- **Out of faculty activities**
- **Publications**

# Sub-division overview "Fatigue properties and acoustic emission"



0,45

0,35

0,50



0,3

0,5

## Laboratories

Classical and contact fatigue

Acoustic emissions

Prototypes

# Teaching

Courses guarantor:

Winter semester 1st year

1K, 1K-K, 1K-A

*Machine Design Fundamentals  
Selected Chapters from MDF*

Summer semester 1st year

2K, 2K-K, 2K-A

*Machine Design*

Doctoral studies

9NTK

*Non-destructive testing and quality management*

Bachelor and master theses ...

# Teaching PhD students

## Marie Boháčová

**Design of eddy current probe and its application for testing of composite and metallic materials used in aviation**

She successfully completed her studies in January 2018 (Material Sciences)

## Houssam Mohammad

**Pneumatic systems diagnostics by acoustic emission method**

He successfully completed his studies in July 2019

## Vendula Skřivánková

**Identification of fatigue damage of materials produced by selective laser melting using non-destructive testing methods**

State doctoral exam - 2018

## Mohamed Housam

**Research and development of means for advanced active diagnostics of toroidal bearings**

2019 - 2023



# Research activities

# Projects TAČR

## Mobile apparatus for defect detection of pneumatic systems

2018-2020 Poličské strojírný a.s. , total volume of funds for BUT is about CZK 3,8 mil.

The aim of the project is the research and development solution as well as the operational verification of the mobile unit for the detection of air leakage from pneumatic systems. Support in the form of subsidies will enable the researcher to realize the research and development to the required extent while using the research potential of the university. The main purpose of the project is to create a mobile air leakage search unit for inspection and service activities. The technical solution will use advanced ultrasound and noise detection methods. The output of the project solution will be the prototype of the unit and its verification in practice.



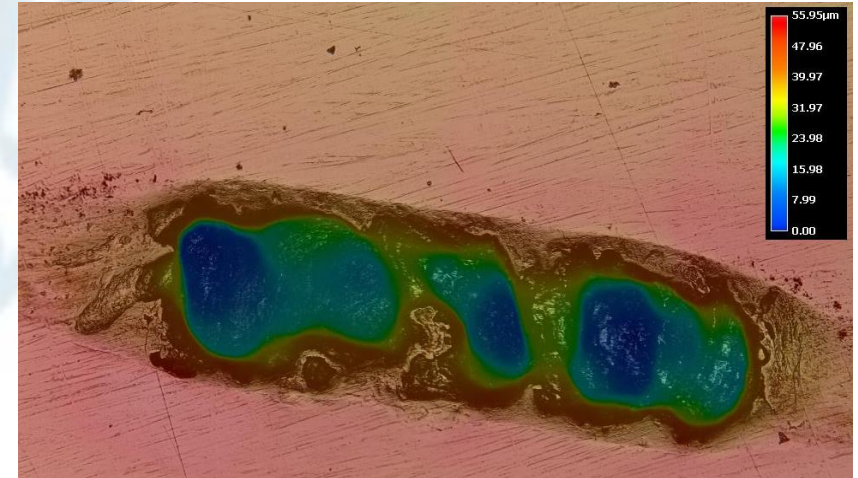
# Research activities

## Projects TAČR

**Research and development of design and technology of the new generation of spherical roller thrust bearings**

**2017–2020 ZKL a.s. Brno, the total volume of funds for BUT is about CZK 2,8 mil.**

Development of design and manufacturing technology of spherical roller thrust bearings with higher utility parameters. Using contemporary knowledges in the field of physical phenomena, materials and technologies of machining or molding to achieve high product life. Further deepening of the knowledge base for more accurate non-destructive diagnostics of surface damage development due to contact loading.



ZKL GROUP

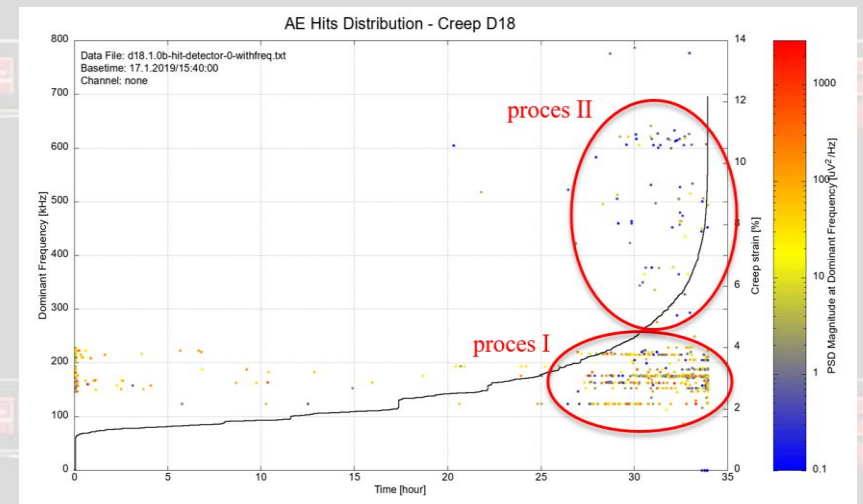
# Research activities

MPO (Trio)

## The continuous acoustic emission analyzer for diagnostics of erosion-corrosion and creep damage of pipeline systems

2017–2019 ZD Rpety stř. Dakel Praha, (UTIA AV ČR v.v.i., UJP PRAHA a.s., VUT v Brně)  
total volume of funds for BUT is about CZK 0.8 million

The aim of the project is a proposal and a construction of a diagnostic device and methods using acoustic emission (AE) for diagnosis and monitoring of an operational damage of high pressure piping systems operated at high temperature regimes. The focus of the project is the diagnostics of the corrosion damage of pipeline walls, and diagnostics of spreading cracks that arise as a result of creep damage. Diagnosis based on the acoustic emission (AE) is perspective in this area because it is non-destructive. In contrast to other common methods based on ultrasound testing, it is also suitable for long-term monitoring in large scale. It allows to record AE signals from a number of locations simultaneously, and analyse them in real time. The outcome of the project is a diagnostic system based on AE, implemented for diagnosing and evaluation of the erosion corrosion and the creep. Another outcome is a software (SW) for evaluating the AE data including their visualization.





# Research activities

MPO (Trio)

**The new generation of bearings for railway applications with extended service Interval  
(Nová generace ložisek pro železniční aplikace s prodlouženým servisním intervalem)**

2017–2020 ZKL a.s. Klášterec nad Ohří ( ZKL VaV a.s. Brno, VUT v Brně)  
total volume of funds for BUT is about CZK 3 mil.



The project is dedicated to the attention to the development of lubricant with the demand for an increased service life exceeding the planned raid kilometres to general repairs of the chassis. This will be grease with suitable additives. At the same time it is necessary to ensure the appropriate tribological conditions in contact of rolling element with the raceways. The modification of geometry will be made to maintain the bearing performance parameters, reduce the friction in contact and to facilitate the renewal of the lubricant film on the surface of the parts. Bearings with innovated parameters of geometry and the composition of the lubricant will be subjected to the tests in the laboratory and operating conditions. The project's goal is to achieve an extension of the service intervals of bearings, the development of the new composition of the grease and the innovation of the internal structure of selected axle bearings. The output of the project is a certified prototype of bearing and deepening of the knowledge in the field of tribology.

# Research activities

MPO (Trio)

**Research and development of full complement toroidal roller bearings up to outer diameter 400 mm (Výzkum a vývoj toroidních ložisek s plným počtem valivých těles do vnějšího průměru 400 mm)**

**2017–2020 ZKL a.s. Brno ( ZKL VaV a.s. Brno, ZKL Tech - Tools, a.s., VUT v Brně)  
total volume of funds for BUT is about CZK 3 mil.**

Toroidal Roller Bearings compared to other bearings are characterized by a special design, which can combine the self-aligning capability with the axial displacement ability. Also has ability to carry high loads with small installation space requirements. These abilities have a direct benefit to reduce different factors in arrangement, as noise, vibration, operation temperature and galling. The bearings find usage in Paper Machines, Wind Turbines, Steel Continual Casters, etc. Are suitable for longer shafts. Within the Project are solved research and simulation toroidal contact and power condition in Toroidal Roller Bearing. The aim is development of nine prototypes of Toroidal Roller Bearings, research of technological process for production and research testing station for these bearings.



# Research activities

## Other projects and cooperation

NETME Plus

Faculty projects within the CM group and doctoral projects

Economic contracts - classical fatigue, contact fatigue,  
acoustic emission diagnostics

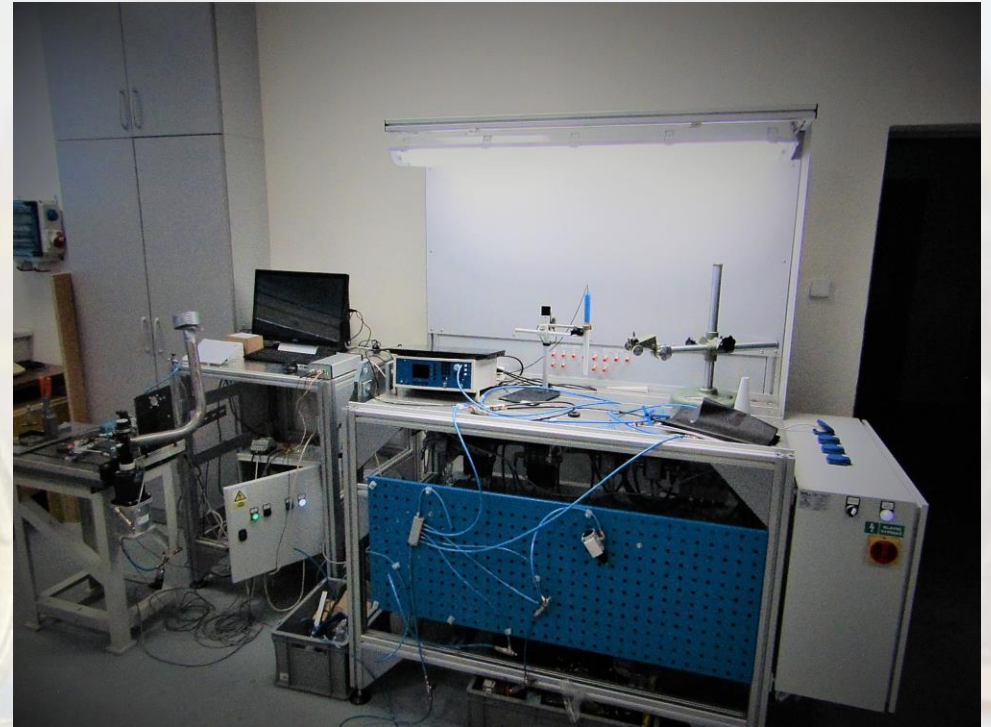
(ABB, Česká Zbrojovka Uherský Brod, ZVL Slovakia)

## Financial benefits (2017 – 2020)

**Total of about CZK 14 million**

## Problems

Permanent changes in the location of our laboratories and their relocation. Unnecessary efforts to equip them and the resulting uncertainty in solving projects and, of course, students' final works.



# Out of faculty activities

**opponent** Mendelu, ČVUT (FS a FJFI), ZČU (FS)

**TAČR** evaluator

**ČNDT** president (2000 - 2019)  
vice president (since 2019)

**EFNDT** member Board of Directors

# Publications 2018 - 2020

## Articles in magazines

MAHMOUD, H.; MAZAL, P.; VLAŠIC, F. Relationship between acoustic emission signal and loads on pneumatic cylinders. *Nondestructive Testing and Evaluation*, 2019, vol. 2019, no. 34, p. 1-17. ISSN: 1477-2671.

MAHMOUD, H.; VLAŠIC, F.; MAZAL, P.; JÁNA, M. Leakage Analysis of Pneumatic Cylinders Using Acoustic Emission. *INSIGHT*, 2017, vol. 59, no. 9, p. 500-505. ISSN: 1354-2575.

NOHÁL, L.; MAZAL, P.; VLAŠIC, F.; SVOBODOVÁ, M. Acoustic Emission Response to Erosion-Corrosion and Creep Damage in Pipeline Systems. *Procedia Structural Integrity*, 2020, vol. 2019, no. 23, p. 227-232. ISSN: 2452-3216.

MAZAL, P.; MAHMOUD, H.; VLAŠIC, F. Diagnostics of the function of pneumatic actuators using acoustic emission. *Badania Nieniszczace i Diagnostyka*, 2019, vol. 2019, no. 4, p. 26-28. ISSN: 2451-4462.

MAHMOUD, H.; MAZAL, P.; VLAŠIC, F. Метод акустической эмиссии для неразрушающего контроля пневматических цилиндров. *NDT world*, 2018, roč. 21, č. 4, s. 64-67. ISSN: 1609-3178.

KRATOCHVÍLOVÁ, V.; VLAŠIC, F.; MAZAL, P.; PALOUŠEK, D.; PANTĚLEJEV, L. Analysis of fatigue processes of SLM materials by acoustic emission. *International Journal of Microstructure and Materials Properties*, 2018, vol. 17, no. 3, p. 193-205. ISSN: 1741-8410.

# Publications 2018 - 2020

## Books

KOPEC, B.; NEUGEBAUER, J.; MAZAL, P. *Ultrazvukové zkoušení. Příručky NDT. Příručky NDT.* Brno: VUTIUM Brno, 2019. 258 s. ISBN: 978-80-214-5722-5.

KOPEC, B.; MAZAL, P. *Magnetická prášková metoda. NDT příručky. NDT příručky.* Brno: VUTIUM Brno, 2018. 244 s. ISBN: 978-80-214-5669-3.

KOPEC, B.; MAZAL, P. *Zkoušení kapilární. NDT příručky. NDT příručky.* Brno: VUTIUM Brno, 2018. 176 s. ISBN: 978-80-214-5625-9.

## Conferences abroad - selection

RICHTER, V.; MAZAL, P.; MAHMOUD, H.; SKŘIVÁNKOVÁ, V. *Parameters of Acoustic Emission Signal Proposed to Identification of Damaged and Undamaged Cylinders.* 33rd European Conference on Acoustic Emission (EWGAE). 1. SENLIS, France: CETIM Senlis, 2018. p. 51-63.

SKŘIVÁNKOVÁ, V.; VLAŠIC, F.; MAZAL, P.; PALOUŠEK, D. *Acoustic Emission Response to Fatigue Damage of Additively Produced and Cast Materials.* In *12th European conference on Non-Destructive Testing.* Gothenburg, Sweden: Sweden MEETX AB | Ref. ECNDT2018, 2018. p. 1-7. ISBN: 978-91-639-6217-2.

KRATOCHVÍLOVÁ, V.; VLAŠIC, F.; MAZAL, P.; PALOUŠEK, D. *Fatigue Behaviour Evaluation of Additively and Conventionally Produced Materials by Acoustic Emission Method.* In *2nd International Conference on Structural Integrity, ICSI 2017, 4-7 September 2017. Procedia Structural Integrity.* Funchal, Madeira, Portugal: Elsevier B.V., 2017. p. 393-400. ISSN: 2452-3216.

# Publications 2018 - 2020

## Conference - Czech Rep.

HLOŽEK, J.; MAZAL, P.; NOHÁL, L. ZMĚNY SIGNÁLU AKUSTICKÉ EMISE V DŮSLEDKU DYNAMICKÉHO ZATĚŽOVÁNÍ LOŽISKOVÉ OCELI 100Cr6. Brno: VUTIUM, ČNDT, 2019. s. 33-40.

FIALA, J.; MAZAL, P.; SKŘIVÁNKOVÁ, V.; MAHMOUD, H. MAGICKÝ SEDMIÚHELNÍK ÚNAVY ANEB ÚNAVA JE BIMODÁLNÍ PROCES. Brno: VUTIUM, ČNDT, 2019. s. 21-32.

BUKÁČEK, V.; VLAŠIC, F.; MAHMOUD, H.; MAZAL, P. PROVOZNÍ A LABORATORNÍ ZKOUŠKY PNEUMATICKÝCH POHONŮ. Brno: VUTIUM, ČNDT, 2019. s. 9-19.

SKŘIVÁNKOVÁ, V.; VLAŠIC, F.; MAZAL, P. ODEZVA AKUSTICKÉ EMISE NA ÚNAVOVÉ POŠKOZOVÁNÍ ADITIVNĚ VYROBENÉHO A ODLITÉHO MATERIÁLU. In *Defektoskopie 2018 / NDE for Safety 2018*. Brno: Vysoké učení technické v Brně ve spolupráci s Českou společností pro NDT, z.s., 2018. s. 277-285. ISBN: 978-80-214-5684-6.

SKŘIVÁNKOVÁ, V.; VLAŠIC, F.; SUCHÝ, J.; PALOUŠEK, D.; MAZAL, P. STUDY OF FATIGUE LOADING OF THE SLM AND CAST MATERIAL BY ACOUSTIC EMISSION METHOD. In *Metal 2018 - 27th International Conference on Metallurgy and Materials, Conference Proceedings*. Ostrava: TANGER LTD., 2018. p. 1345-1350. ISBN: 9788087294840.

MAHMOUD, H.; MAZAL, P.; VLAŠIC, F.; NOHÁL, L. LEAKAGE DETECTION FOR PNEUMATIC CIRCLE OF BUS DOOR USING ACOUSTIC EMISSION AND OTHER NDT METHODS. In *Defektoskopie 2018 / NDE for Safety 2018*. Brno: VUT v Brně a Česká společnost pro NDT, z.s., 2018. p. 67-77. ISBN: 978-80-214-5684-6.

etc.

**THANK YOU FOR YOUR ATTENTION**  
**DĚKUJI ZA POZORNOST**



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