

A grayscale photograph of an ESA rocket launch, showing the rocket ascending from the Earth's surface with a large plume of white smoke and fire. The ESA logo is visible on the side of the rocket.

Outline of research and educational activities

Michal Kubík

UK ústav
konstruování

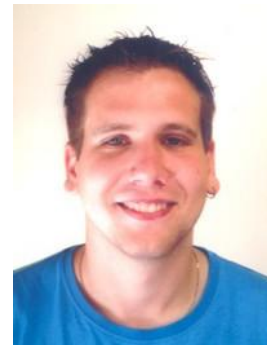
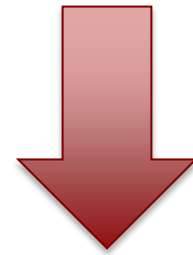
Supervisor: Doc. Ing. Ivan Mazůrek CSc.

Supervisor specialist: Ing. Jakub Roupec Ph.D.

Presentation

19.11. 2014, FME BUT in Brno, Czech Republic

Technical Diagnostics research group



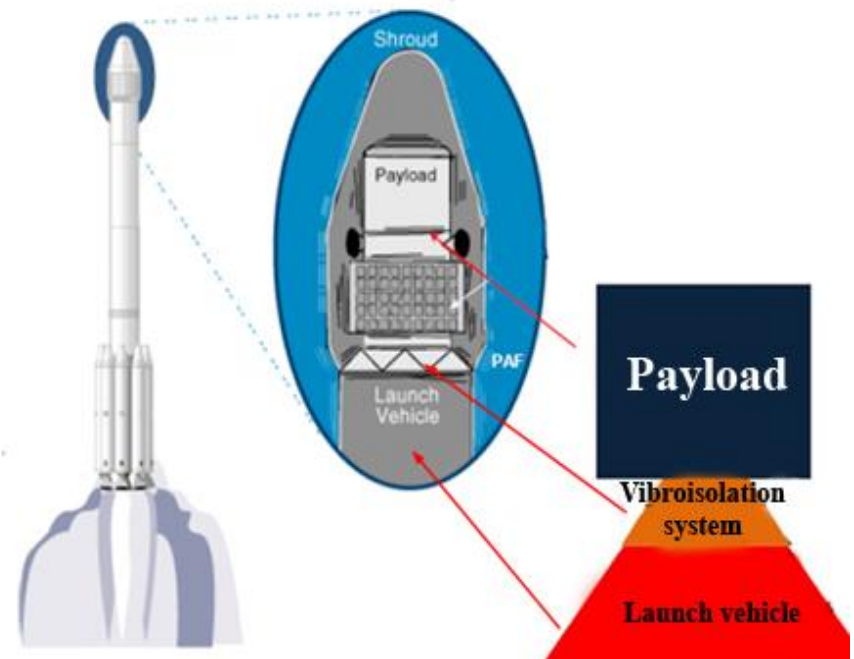
- Research activities
- Dissertation thesis
- Teaching activities
- Learning activities

Semi-active Damping System – FLPP 3

The aim of the project is to develop a semi-active damping system that allows decrease transmission of vibration from launch vehicle to payload.



Honeywell



<http://honeywell.com/>

Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

The goal of the dissertation:

- Development of semi-active MR damper for vibroisolation system in launch vehicle

The sub-goal of the dissertation:

- Development of mathematical models of MR damper
- Design of experimental device
- Experimental verification of mathematical models
- Experimental verification effectivity of MR damper in different isolation systems

Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

History of research of Magnetorheological (MR) fluid

- 1940 Rabinow discover MR fluid
- In the 90s was developed first design of MR damper (basic design)
- Boom in research of MR fluid(dampers) began of the 21st century

Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

Studies focused
on MR valve

Design of MR
damper

1996

Carlson

-First design of MR damper

2002

Yoo

- Different material of magnetic circuits

Hydraulic model of
MR damper

2002

Yang, Carlson

-Velocity profile of MR fluid in magnetic field ⇒ Bingham model

2007

Weng

-Velocity profile ⇒ Power law model
-Design phase ⇒ Bingham model

MR fluid (limits of
MRF)

2000

Carlson

-Properties of commercial MR fluid
-Minimal volume of MRF
-Time response

2005

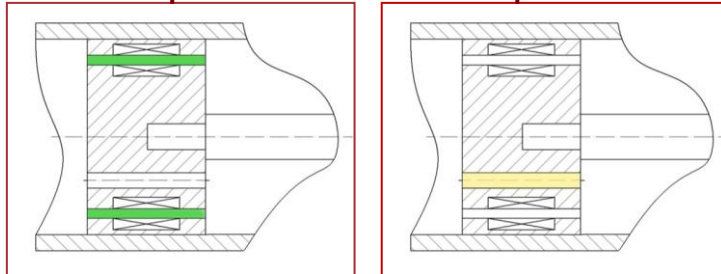
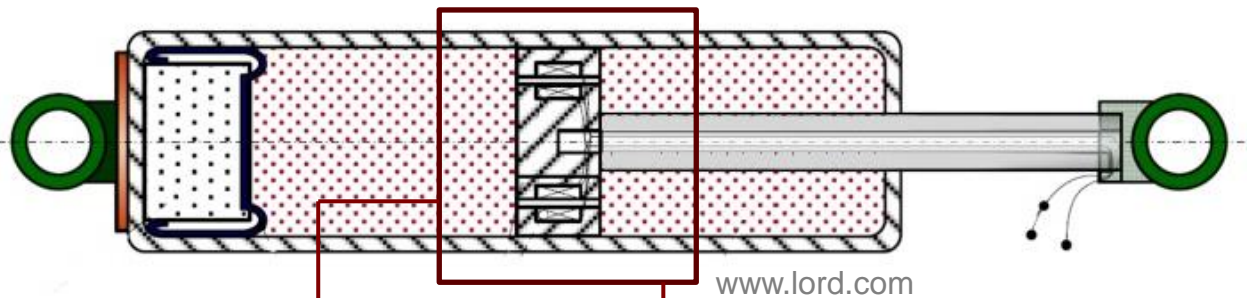
Goncalves

-Dwell time of MR fluid

Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

Hydraulic model of MR damper



Magnetic gap + bypass gap

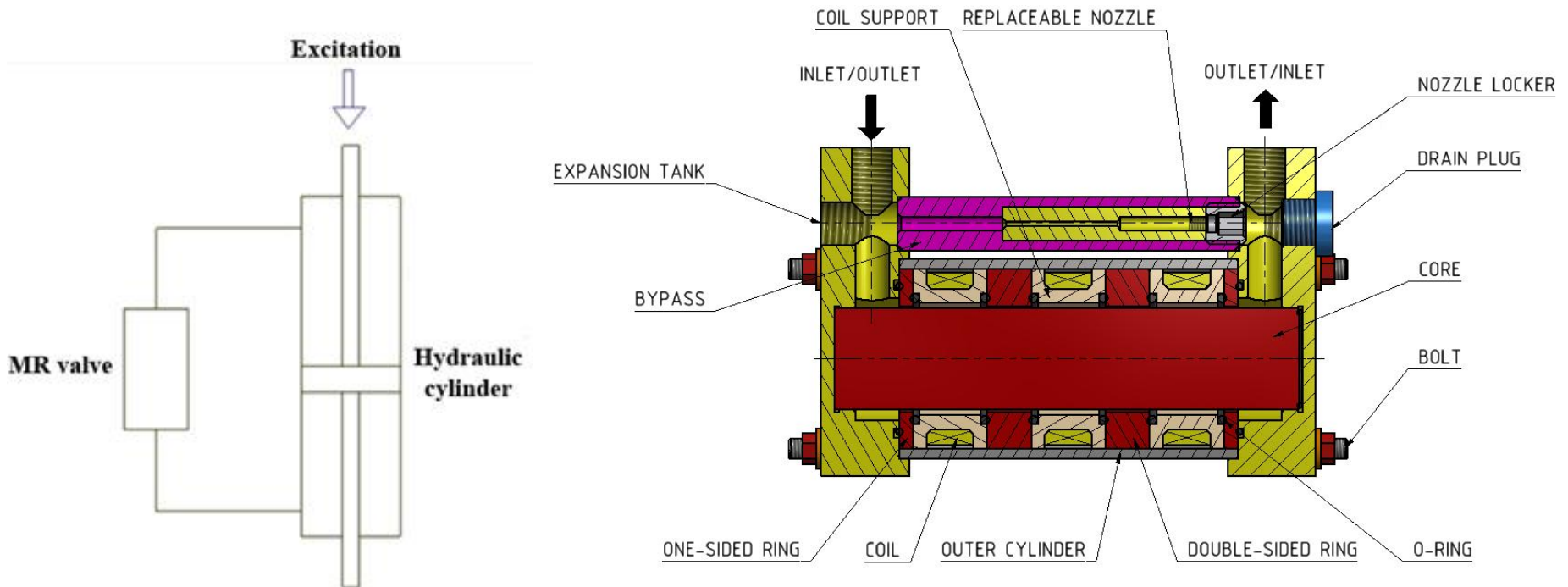


Development of hydraulic model
of MR damper

Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

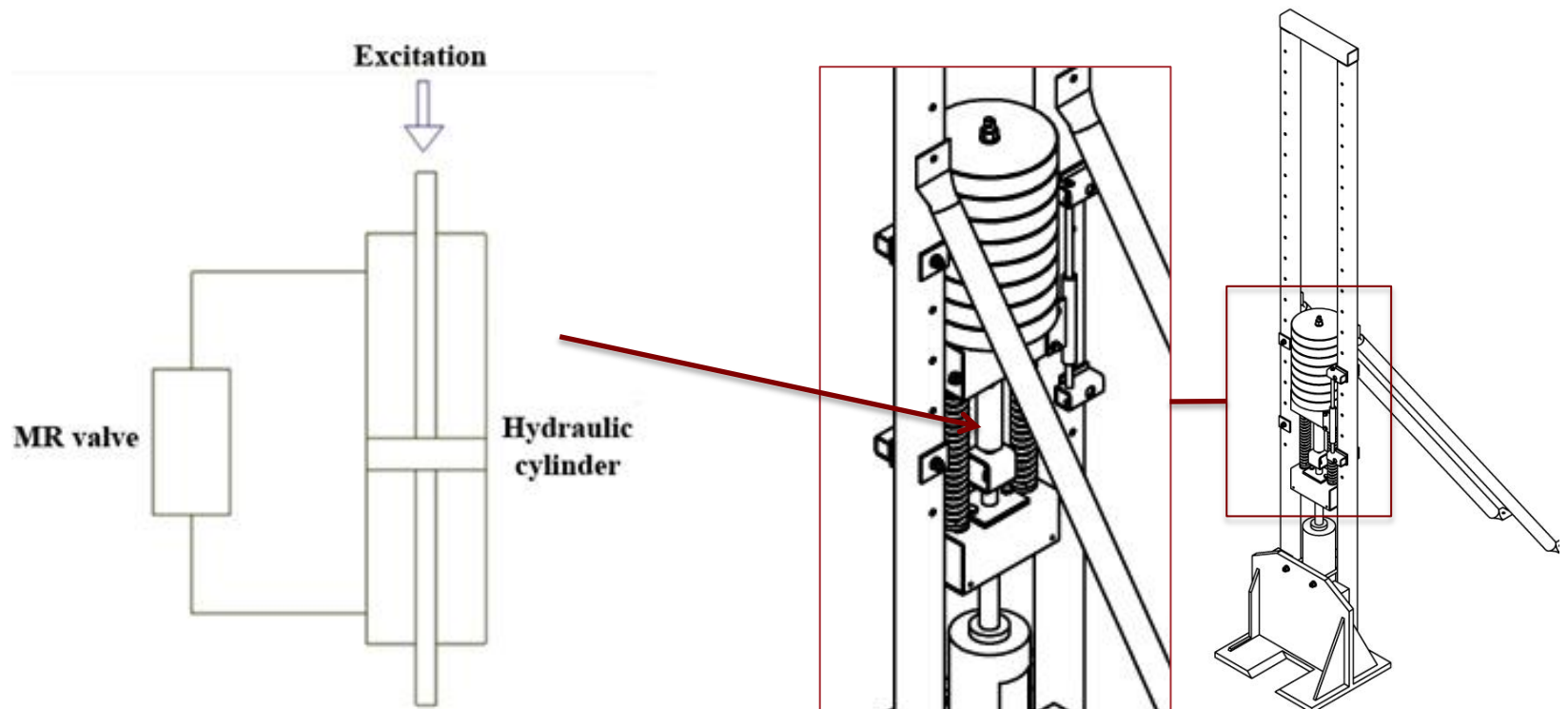
Experimental apparatus



Name of my dissertation thesis:

Development of magnetorheological damper for cosmonautics

Experimental apparatus



Winter semester

■ **5KS** (Machine Design – Machine Elements)

Summer semester

- **6KM** (Machine Design – Mechanisms)
- **QEM** (Experimental Methods)
- **ZIP** (Design Project)

Learning activities

■ **9MOP** (Methodologies of Scientific Work)



■ **9VPR** (Research Project and its Manag.)



■ **9AJ** (English for Doctoral Degree Study)



■ **9PEX** (Experiment Control by Computer)



■ **9APH** (Applied hydrodynamics)



■ Products

KUBÍK, M.: MR ventil; *Program pro simulaci hydraulických a reologických poměru nového MR ventilu*. místnost A2/ 412, ÚSTAV KONSTRUOVÁNÍ, Fakulta strojního inženýrství, Vysoké učení technické v Brně, Technická 2896/ 2, 616 69 BRNO, Česká Republika. URL: http://pom.uk.fme.vutbr.cz/pdf_projekt.php?id= 308. (software)

■ Publications

KUBÍK, M.; MAZŮREK, I. Design of semi- active magnetorheological valve. In *55th International Conference of Machine Design Department*. 2014. s. 45-50. ISBN: 978-80-01-05542- 7.

STRECKER, Z.; ROUPEC, J.; KUBÍK, M.; FRIEDEL, D. Experimental evaluation of MR damper time response on modified Groundhook algorithm efficiency. In *Engineering Mechanics 2014*. 1st. 2014. s. 600-603. ISBN: 978-80-214-4871- 1.

A grayscale photograph of an ESA rocket launch, showing the rocket ascending from the Earth's surface with a large plume of white smoke and fire. The ESA logo is visible on the side of the rocket.

Thank you for your attention

M. Kubík

UK ústav
konstruování

Institute of Machine and Industrial Design

Faculty of Mechanical Engineering

Brno University of Technology

Presentation

19.11. 2014, Czech Republic