

9:00 a.m. WELCOME & OPENING ADDRESS

9:10 a.m. **Materials**



Chair: Gordon Mohn

9:10 a.m. A-1 Challenges for novel lead free alloys in hydraulics
Björn Reetz, Otto Fuchs KG, Germany

9:35 a.m. A-2 Researches on waterhydraulic motor
Franc Majdič, University of Ljubljana, Faculty of mechanical engineering, Slovenia

10:00 a.m. A-3 Orifices flow saturation in oil hydraulic applications
Pietro Marani, CNR IMAMOTER, Italy

System design & integration



Chair: Oliver Koch

B-1 Frequency based efficiency evaluation – From pattern recognition via backwards simulation to purposeful drive design
Martin Starke, TU Dresden, IMD, Germany

B-2 Optimization of operation strategy for primary torque based hydrostatic drivetrain using artificial intelligence
Yusheng Xiang, Karlsruhe Institute of Technology, Germany

B-3 Hardware-in-the-loop simulation of hybrid hydromechanical transmissions
Viktor Larsson, Linköping University, Sweden

Novel system solutions



Chair: Dr.-Ing. Mark Krieg

C-1 A closed circuit electro-hydraulic actuator with energy recuperation capability
Shaoyang Qu, Purdue University, USA

C-2 Analysis of novel zonal two - cylinder actuation system for heavy loads
Tatiana Minav, Tampere University, Finland

C-3 Experimental evaluation of an electro-hydrostatic actuator for subsea applications in a hyperbaric chamber
Amadeu Placido Neto, Bosch Rexroth AG, Germany

10:30 a.m.

BREAK

11:00
a.m.

Additive manufacturing



Chair: Dr.-Ing. Alexander Leonhard

11:00 a.m. D-1 Tribological investigations on additively manufactured surfaces using Extreme High-Speed Laser Material Deposition (EHLA) and Laser Powder Bed Fusion (LPBF)
Achill Holzer, RWTH Aachen, IFAS, Germany

11:25 a.m. D-2 Assessment of frictional losses to horizontally built fluid passages using additive manufacturing
Yi Zhu, Zhejiang University, China

11:50 a.m. D-3 Design and experimental investigation of an additive manufactured compact drive
Gunnar Matthiesen, RWTH Aachen, IFAS, Germany

12:15 a.m. D-4 Additive manufacturing of hydraulic manifolds- A holistic approach across the entire value chain
Bastian Beckmann, Bosch Rexroth AG, Germany

Components



Chair: Dr.-Ing. Jens Krallmann

E-1 Functional proof of a flat slide valve as a 4/3-way proportional valve
Stefan Aengenheister, RWTH Aachen, IFAS, Germany

E-2 Control concept for a grease lubricated hydrostatic bearing
Igor Mass, Hochschule Niederrhein, Germany

E-3 Foam accumulators: Packaging and weight reduction for mobile applications
Manuel Rexer, TU Darmstadt, Germany

E-4 One dimensional unsteady model of a hydro-pneumatic piston accumulator based on Finite Volume Method
Felix Fischer, RWTH Aachen, IFAS, Germany

Intelligent control



Chair: Prof. Dr.-Ing. Steffen Ihlenfeldt

F-1 Simulation of an interlocking hydraulic direct-drive system for a biped walking robot
Juri Shimizu, Waseda University and Hitachi Ltd., Japan

F-2 Nonlinear force tracking control of electrohydrostatic actuators submitted to motion disturbances
Tahereh Vaezi, Université de Lyon, INSA de Lyon, France

F-3 Multidimensional flow mapping for proportional valves
André Sitte, TU Dresden, LFD, Germany

F-4 Multi-objective control of a self-locking compact electro-hydraulic cylinder drive
Nikolaj Grønkrær, Aalborg University, Denmark

12:45
a.m.

LUNCH

**1:45
p.m.**

Fluids



Chair: Prof. Dr.-Ing. Katharina Schmitz

**1:45
p.m.**

- G-1 Numerical prediction and experimental investigation of cavitation erosion of hydraulic components using HFC
Atena Moosavi, TU Dresden, LFD, Germany

**2:10
p.m.**

- G-2 Basic aspects when using ionic liquids as hydraulic fluid
Darko Lovrec, University of Maribor, Slovenia

**2:35
p.m.**

- G-3 Computational approach to the experimental determination of diffusion coefficients for oxygen and nitrogen in hydraulic fluids using the pressure-decay method
Andris Rambaks, RWTH Aachen, IFAS, Germany

**3:00
p.m.**

- G-4 Optimizing hydraulic reservoirs using Euler-Euler-Lagrange multiphase CFD simulation
Lukas Muttenthaler, Johannes Kepler University and Engel Austria GmbH, Austria

Pumps



Chair: Michael Fabianek

- H-1 The influence of the swash plate oscillation on pressure ripple in variable displacement axial piston pump
Xiaochen Huang, Zhejiang University, China

- H-2 Investigation of the wear behavior of the slipper in an axial piston pump by means of simulation and measurement
Roman Ivantysyn, TU Dresden, LFD, Germany

- H-3 A fast approach for coupled fluid-thermal modelling of the lubricating interfaces of axial piston machines
Swarnava Mukherjee, Purdue University, USA

- H-4 A CFD design of engineered surface for tribological performance improvements in hydraulic pumps
Fabio Scolari, Università di Parma, Italy

Mobile applications



Chair: Prof. Dr.-Ing. Frank Will

- I-1 Optimization of hydrostatic-mechanical transmission control strategy by means of torque control
Yusheng Xiang, Karlsruhe Institute of Technology, Germany

- I-2 Reinforcement learning: A control approach for reducing component damage in mobile machines
Lars Brinkschulte, Karlsruhe Institute of Technology, Germany

- I-3 Intelligent Twin Steering System
Biagio Borretti, Dana Motion Systems Italia S.r.l., Italy

- I-4 Autonomous control of hydraulic mobile applications – a 21-ton excavator case study
Timothy John Opperwall, Husco International Inc., USA

**3:30
p.m.**

BREAK

4:00
p.m.

Fundamentals



Chair: Prof. Dr.-Ing. Peter Pelz

4:00
p.m.

4:25 p.m. J-1 Experimental tests of fluid exchange process improvement in a new design of hydraulic cylinder with a supply system
Tomasz Siwulski, Wrocław University of Science and Technology, Poland

4:50 p.m. J-2 Dirt ingress behavior of wipers: Analysis approach
Gonzalo Barillas, Freudenberg Sealing Technologies GmbH, Germany

5:15 p.m. J-3 The applicability of the mass-flow-model according to ISO 6358 with the parameter critical conductance C and critical pressure ratio b for gases in high pressure range up to 300 bar
Lucian Pasiaka, Eugen Seitz AG, Switzerland

Pumps



Chair: Dr.-Ing. Robert Rahmfeld

K-1 Damping strategies for energy efficient pressure controllers of variable displacement pumps
Tobias Pietrzyk, RWTH Aachen, IFAS, Germany

K-2 Optimization of the tribological contact of valve plate and cylinder block within axial piston machines
Stefan Geffroy, RWTH Aachen, IFAS, Germany

K-3 Numerical and experimental study on novel hydraulic pump concept
Seong-Ryeol Lee, RWTH Aachen, IFAS, Germany

K-4 A numerical model for the evaluation of gerotor torque considering multiple contact points and fluid-structure interactions
Zubin Mistry, Purdue University, USA

Mobile applications



Chair: Prof. Dr.-Ing. Marcus Geimer

L-1 Challenges and possibilities of the integration of electric drives in mobile machinery
Andreas Opgenoorth, RWTH Aachen, IFAS, Germany

L-2 Research on efficient driving method of heavy hydraulic excavator boom
Lianpeng Xia, Taiyuan University of Technology, China

L-3 Optimal control of the hydraulic actuated boom system based on Port-Hamiltonian formulation
Lingchong Gao, TU München, Germany

L-4 The use of a holistic machine simulation for the development of hydraulic hybrid modules to reduce transient engine-out emission
Felix Pult, Karlsruhe Institute of Technology, Germany

TUESDAY, October 13, 2020

9:00 a.m. WELCOME & OPENING ADDRESS

Prof. Dr.-Ing. Michael Beckmann

Dean of the Faculty of Mechanical Science and Engineering,
Technische Universität Dresden

Thomas Schmidt

Saxonian State Minister for Regional Development

Christian H. Kienzle

Chairman of the Board of the Fluid Power Association within VDMA
CEO of ARGO-HYTOS Group AG

9:45 a.m. Digital systems



Chair: Peter-Michael Synek

9:45 a.m. **1-0 General Lecture:**
Digital mobile machines – From cloud down to earth
Jürgen Weber, TU Dresden, LFD, Germany

10:15 a.m. **1-1 General Lecture:**
Industrial hydraulics: Now – Next – Beyond
Steffen Haack and Mark Krieg, Bosch Rexroth AG, Germany

10:45 a.m.

BREAK

11:15
a.m.

Digital systems



Chair: Dr.-Ing. Steffen Haack

- 11:15 a.m. **2-0** **General Lecture: Digitization of the hydraulics – uniform semantics only allows interoperability**
Martin Hankel, Bosch Rexroth AG, Germany
- 11:45 a.m. **2-1** **Interoperable information model of a pneumatic handling system for plug-and-produce**
Raphael Alt, RWTH Aachen, IFAS, Germany
- 12:05 a.m. **2-2** **B2MML as an exchange format for asset administration shells as part of a Plug-and-Produce process for a fluid power engineering application**
Hartmut Schweizer, TU Dresden, IAI, Germany
- 12:25 a.m. **2-3** **A reference architecture for cyber-physical fluid power systems: Towards a smart ecosystem**
Dominik Martin, Karlsruhe Institute of Technology and Trelleborg Sealing Solutions Germany GmbH, Germany

12:45
a.m.

Novel displacement machines



Chair: Prof. Dr. Rudolf Scheidl

- 3-0** **General Lecture: Displacement machines – key elements of future technology**
Robert Rahmfeld, Danfoss Power Solutions GmbH & Co. OHG, Germany
- 3-1** **Applying a multi-service Digital Displacement® pump to an excavator to reduce valve losses**
Matteo Pellegrini, Artemis Intelligent Power Ltd., UK
- 3-2** **Digital pumps in speed-controlled systems – an energy study for a loader crane application**
Samuel Kärnell, Linköping University, Sweden
- 3-3** **Design and testing of pistons and cups for large hydrostatic pumps and motors**
Peter Achten, INNAS, Netherlands

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TUESDAY, October 13, 2020

1:45
p.m.

Industrial applications



Chair: Dr.-Ing. Edgar Weishaupt

1:45
p.m.

4-0 **General Lecture: User-oriented systematic of control concepts for fluid-mechatronic servo drives**

Peter Anders, HS Furtwangen, Germany

2:15
p.m.

4-1 **CytroConnect – A cloud-based IoT-service as connectivity solution for electrohydraulic systems**

Martin Laube, Bosch Rexroth AG, Germany

2:35
p.m.

4-2 **Fluid-thermal co-simulation for a high performance concrete machine frame**

Christoph Steiert, TU Dresden, LFD, Germany

2:55
p.m.

4-3 **Investigation of energy management topologies for forming presses with electro hydrostatic drivetrains**

Tim Reidl, Moog GmbH, Germany

Components



Chair: Dr.-Ing. Marcus Fischer

5-1

State of the art digital on-board-electronics vs. potentially disruptive control architectures for hydraulic valves
Achim Richartz, Bosch Rexroth AG, Germany

5-2

Optimization of directional control valves through downstream compensation approach
Davide Mesturini, Walvoil SpA, Italy

5-3

Evolution mikro – Micro-dosing in the high-pressure range thanks to innovative drive technology
Bernd Freissler, ProMinent GmbH, Germany

5-4

CFD aided optimization of customer specific tank systems using an innovative labyrinth de-aerator
Karl Wartlick, ARGO-HYTOS GmbH, Germany

3:15
p.m.

BREAK

3:45
p.m.

Predictive maintenance



Chair: Prof. Dr.-Ing. Peter Post

- 3:45 p.m. 6-1 Validation of a soft sensor network for condition monitoring in hydraulic systems
Jakob Hartig, TU Darmstadt, Germany
- 4:15 p.m. 6-2 Predictive maintenance with a minimum of sensors using pneumatic clamps as an example
Wolfgang Gauchel, Festo AG & Co. KG, Germany
- 4:35 p.m. 6-3 Development of a lumped parameter model of an aerospace pump for Condition Monitoring purposes
Geneviève Mkadara, Institut Clément Ader, France
- 4:55 p.m. 6-4 Condition monitoring systems for hydraulic accumulators - Improvements in efficiency, productivity and quality
Christian Nisters, HYDAC Technology GmbH, Germany

5:30
p.m.

KEYNOTE SPEECH

Dr.-Ing. Christian Ludwig, Kamax Tools & Equipment GmbH, Germany

Electro-hydraulic actuators



Chair: Prof. Dr.-Ing. Peter Anders

- 7-0 **General Lecture: Electrohydrostatic actuation system – an (almost) complete system view**
Dirk Becher, Moog GmbH, Germany
- 7-1 Flexible and easy to engineer servo-hydraulic actuators using 3D printing manufacturing process
Till Deubel, Bosch Rexroth AG, Germany
- 7-2 Electro-hydrostatic compact drives with variable transmission ratio
Giacomo Kolks, TU Dresden, LFD, Germany
- 7-3 Robustness of the Liebherr-Aerospace EHA technology for future flight control application
Tobias Röben, Liebherr-Aerospace Lindenberg GmbH, Germany

WEDNESDAY, October 14, 2020

9:00
a.m.

Pneumatics



Chair: Prof. Victor Juliano De Negri

9:00
a.m.

8-0 General Lecture: Pneumatics and Industrie 4.0 – opportunity or contradiction?

Peter Post, Festo AG & Co. KG, Germany

9:30
a.m.

8-1 Increase of energy efficiency in vacuum handling systems based on biomimetic principles

Harald Kuolt, J. Schmalz GmbH, Germany

9:50
a.m.

8-2 Behaviour and impact of leakage in vacuum gripping systems

David Straub, J. Schmalz GmbH, Germany

10:10
a.m.

8-3 Much does not help much: 3D pareto front of safety, comfort and energy consumption for an active pneumatic suspension strut

Manuel Rexer, TU Darmstadt, Germany

10:30
a.m.

8-4 Combinations of energy saving measures in pneumatics

Vladimir Boyko, TU Dresden, LFD, Germany

11:00
a.m.

Mobile applications



Chair: Dr.-Ing. Oliver Martens

9-0

General Lecture: ZF view on future drivetrains for compact and medium size wheel loaders

Jürgen Legner, ZF Friedrichshafen AG, Germany

9-1

Agrothermie – Design and testing of a novel hydraulically-actuated, locally vibrating plough

Jianbin Liu, TU Dresden, LFD, Germany

9-2

Assistance system for an automated log-quality and assortment estimation based on data-driven approaches using hydraulic signals of forestry machines

Chris Geiger, Karlsruhe Institute of Technology, Germany

9-3

Emission reduction by hydraulic hybrids

Kalevi Huhtala, Tampere University, Finland

9-4

Design and performance evaluation of next generation clutch control valve

Michael Erhard, Thomas Magnete GmbH, Germany

BREAK

11:30
a.m.

Special domains



Chair: Prof. Andrew Plummer

11:30
a.m.

10-0 General Lecture: The roof wing opening system of the UAE pavilion at Expo 2020

Paolo Leutenegger and Carlo Vergano, Duplomatic Motion Solutions SpA, Italy

12:00
a.m.

10-1 Preliminary design and testing of a servo-hydraulic actuation system for an autonomous ankle exoskeleton

Emmanuel Viennet, School of Engineering and Architecture of Fribourg, Switzerland

12:20
a.m.

10-2 Miniature hydraulics for a mechatronic lower limb prosthesis

Christian Stentzel, TU Dresden, IMD, Germany

12:40
a.m.

10-3 Fully variable, simple, and efficient - electrohydraulic - valve train for reciprocating engines

Wolfgang Schneider, W. Schneider Ingenieurbüro, Switzerland

1:00
p.m.

Mobile applications



Chair: Dr.-Ing. Thomas Fedde

11-1

Active automatic chassis actuation for an excavator

Christoph Boes, Moog GmbH, Germany

11-2

Integrated smart hydraulic displacement machine for closed systems

Rocco Kemnitz, RAPA Automotive GmbH & Co. KG, Germany

11-3

Hydropneumatic all-wheel suspensions: Applications, challenges and special solutions

Wolfgang Bauer, ARGO-HYTOS GmbH, Germany

11-4

Fluid dynamic vibration absorber for cabin suspension

Nicolas Brötz, TU Darmstadt, Germany

LUNCH

WEDNESDAY, October 14, 2020

2:00
p.m.

Novel system architectures



Chair: Dr.-Ing. Christoph Boes

2:00
p.m.

12-0 General Lecture: Model based engineering for electro-hydraulic solutions

Daniel Weiler, Bosch Rexroth AG, Germany

2:30
p.m.

12-1 Bootstrap reservoir concepts for electro-hydraulic compact cylinder drives

Søren Ketelsen, Aalborg University, Denmark

2:50
p.m.

12-2 On the use of singular perturbation based model hierarchies of an electrohydraulic drive for virtualization purposes

Philipp Zagar, Johannes Kepler University Linz, Austria

3:10
p.m.

12-3 Electro-hydraulic SWOT-analysis on electro-hydraulic drives in construction machinery

Martin Inderelst, XCMG European Research Center GmbH, Germany

3:30
p.m.

12-4 Modular independent metering system for mobile applications providing smooth mode transition

Jan Lübbert, TU Dresden, LFD, Germany

3:50
p.m.

Actuators & sensors



Chair: Dr.-Ing. Albert W. Schultz

13-0 General Lecture: MEMS sensors in hydraulics, an opportunity to create smart components

Massimiliano Ruggeri, CNR-IMAMOTER, Italy

13-1 Self-sensing position determination of a sensor-designed proportional solenoid

Thomas Kramer, TU Dresden, LFD, Germany

13-2 On/off solenoid with sensorless position detection

Peter Tappe, Magnet-Schultz GmbH, Germany

13-3 Rotor swivel motor as actuator on an innovative control valve

Ingo Dietrich, TU Darmstadt, Germany

13-4 Experimental and numerical study of a novel piezo-electric pilot stage for servovalves

Andrew Plummer, University of Bath, UK

BREAK

4:20
p.m.

Safety & reliability



Chair: Dr.-Ing. Martin Petzold

4:20
p.m.

- 14-1 Lifetime impact prediction of component modifications in axial piston units by the failure likelihood assessment
Ivan Baus, Danfoss Power Solutions GmbH & Co. OHG, Germany

4:40
p.m.

- 14-2 Simulation-based system reliability analysis of electro-hydraulic actuator with dual modular redundancy
Maxim Andreev, ESI ITI GmbH, Germany

5:00
p.m.

- 14-3 Enabling SIL2 safety certified applications for mobile machine OEMs
Peter Lauer, Eaton Corp., USA

5:40
p.m.

FAREWELL ADDRESS + BEST PAPER AWARD

Jürgen Weber, TU Dresden, LFD, Germany

Actuators & sensors



Chair: Dr.-Ing. Markus Laufenberg

- 15-1 Development and control of smart pneumatic McKibben muscles for soft robots
Min Pan, University of Bath, UK

- 15-2 Multistable valve technology with magnetic shape memory alloy as passive element activated by a bidirectional solenoid actuator
Julius Happel, ETO Magnetic GmbH, Germany

- 15-3 Evaluation of a fast measuring ultrasonic flow meter
Bernhard Funck, Flexim GmbH, Germany