

Program

ACTUATOR 22

International Conference and Exhibition on
New Actuator Systems and Applications

**Congress Center Rosengarten
Mannheim, Germany
June 29 – 30, 2022**

www.actuator.de

Organized by:

Society of Microelectronics,
Microsystems and Precision
Engineering (VDE VDI GMM)

VDE



GMM

Welcome to the new ACTUATOR Conference 2022

The ACTUATOR Conference 2022 – may we inform you ...

ACTUATOR is a major biennial event bringing together leading experts, suppliers and users in the field of new actuators and low-power electromagnetic drives from all over the world. The invitation to attend ACTUATOR is aimed at executives and researchers from industrial companies as well as institutes, colleges and universities who are interested in the transfer of R&D results into innovative actuator applications and drive technologies.

ACTUATOR 2022 – together with you on an international stage

With about 400 participants from more than 20 countries, the International Conference on New Actuator Systems and Applications has been the most important place to meet leading international specialists, to share their expertise and to start business co-operations in the field of new actuator technologies.

ACTUATOR – the key forum for actuators

based on smart materials and micro technologies as well as their applications in all areas of engineering for thirty years now. Over the years, a huge variety of excellent ideas and results have been reported. A lot of them have been raised from vision to mass product. Among the success stories you will find quite a number of established applications of new actuators,

in particular their well-known use in fuel injection, adaptive shock absorbers, nanopositioning, precision engineering like camera lenses and other applications of miniaturized drives.

New product generations

In this way, ACTUATOR has launched the realization of new product generations with outstanding compactness and high performance properties which so far have not been achieved in conventional technologies. A small wonder that based on this ignition, resulting in gaining access to new markets.

The Exhibition

The Exhibition on New Actuator Systems and Applications will present components, system approaches and applications of smart actuators and low-power electromagnetic drives based on conventional (electromagnetic) and innovative working principles (new actuators), and associated subjects. The range of topics also includes measurement techniques, control concepts and circuits, driver components and units, system integration, layout and simulation tools etc.

Prof. Dr. Helmut F. Schlaak

Conference Chair

Technical University Darmstadt

Microtechnology and Electromechanical Systems Lab

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The ACTUATOR 2022 Programme Committee

Schlaak, Helmut F. (Chairman) | Technische Universität Darmstadt, Germany (Conference Chair)
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Chikhaoui, Mohamed Taha | Université Grenoble-Alpes, France
Choi, Seung-Bok | The State University of New York, Korea (SUNY Korea), Incheon, South Korea
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Goldasz, Janusz | BWI Beijing West Industries Technical Center Kraków, Poland
Henke, Markus | Technische Universität Dresden, Germany
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Kohl, Manfred | Karlsruher Institut für Technologie, Germany
Krippner, Peter | Bürkert Werke GmbH & Co. KG, Karlsruhe, Germany
Lötters, Joost | Bronkhorst High-Tech B.V., Ruurlo, Netherlands
Maas, Jürgen | Technische Universität Berlin, Germany
Manfredi, Luigi | University of Dundee, Great Britain
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Monner, Hans Peter | German Aerospace Center (DLR), Braunschweig, Germany
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Morita, Takeshi | Tokyo University, Japan
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Müllner, Peter | Boise State University, USA
Pagounis, Emmanouel | ETO MAGNETIC GmbH, Stockach, Germany
Perret, Jérôme | Haption GmbH Aachen, Germany
Pertsch, Patrick | PI Ceramic GmbH, Lederhose, Germany
Pott, Peter | University of Stuttgart, Germany
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Spomer, Waldemar | Physik Instrumente (PI) GmbH & Co. KG, Karlsruhe, Germany
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Uchino, Kenji | The Pennsylvania State University, USA
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Organizer

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Overview

Time	Gustav Mahler Saal I	Gustav Mahler Saal II	Gustav Mahler Saal III	
Wednesday, June 29				
08:45 – 09:00	Opening			p.6
09:00 – 10:30	Plenary Talks			p.6
10:30 – 11:00	Coffee Break			
11:00 – 12:20	A1: Medical Devices / Medical Engineering	B1: Polymer Actuators	C1: Optics	p.6 p.7 p.7
12:20 – 13:50	Lunch Break			
13:50 – 15:10	A2: Microfluidic Handling / Energy Harvester	B2: Electromagnetic Actuators / Magenostrictive Actuators	C2: Aerospace	p.8 p.8 p.9
15:10 – 16:00	Coffee Break			
16:00 – 17:20	A3: Robotics	B3: Actuators Based on ER/MR Fluids	C3: Industrial Applications	p.10 p.10 p.11
Thursday, June 30				
09:00 – 10:30	Plenary Talks			p.12
10:30 – 11:00	Coffee Break			
11:00 – 12:40	A4: SMA (1)	B4: Actuator Control and Electronics	C4: KOMMMA Session (1)	p.12 p.13 p.13
12:40 – 13:40	Lunch Break			
13:40 – 15:10	Poster Sessions P1: Various topics on actuators, P2: Electromagnetic actuators, P3: Micro/nano manipulation and positioning, P4: Piezoelectric actuators / piezoelectric motors, P5: Process engineering, P6: Robotics / micro robotics / soft robotics			p.14
15:10 – 15:30	Coffee Break			
15:30 – 17:10	A5: SMA (2)	B5: Piezoelectric Actuators	C5: KOMMMA Session (2)	p.18 p.18 p.19
17:10 – 17:20	Closing Remarks			p.19

08:45

Opening*Prof. Dr. Helmut F. Schlaak, Chairman**Technical University Darmstadt, Microtechnology and Electromechanical Systems Lab, DE***Plenary Talks***Chairs: Helmut F. Schlaak (Technical University Darmstadt, DE); Jürgen Maas (Technical University Berlin, DE)*

09:00

NEXIPAL(R) - Pushing the value chain of polymer actuators*Andreas Koellnberger (Wacker Chemie AG, DE)*

09:30

Materials for Small-Scale Robotics*Salvador Pané (Swiss Federal Institute of Technology (ETH) Zurich, CH)*

10:00

Bio-Inspired Surgical Instruments*Paul Breedveld (Delft University of Technology & Faculty Mechanical, Maritime & Materials Engineering, NL)***10:30 - 11:00 Coffee Break***Gustav Mahler Saal I***A1****Medical Devices / Medical Engineering***Chairs: Peter P. Pott (Universität Stuttgart, DE); Bert Müller (University of Basel, CH)*

11:00

Characterization of a soft magnetic catheter controlled by a permanent magnet*Mohammad Hasan Dad Ansari (Scuola Superiore Sant'Anna, IT & KU Leuven, BE); Xuan Thao Ha (Katholieke Universiteit Leuven, BE); Mouloud Ourak (KU Leuven, BE); Veronica Iacovacci (Scuola Superiore Sant'Anna, IT); Gianni Borghesan (Katholieke Universiteit Leuven, BE); Emmanuel Benjamin Vander Poorten (KU Leuven, BE); Arianna Menciassi (Scuola Superiore Sant'Anna, IT)*

11:20

Miniature Pneumatic Artificial Muscles for Use in Surgical Devices*Bob Lathrop (KU Leuven, BE); Mouloud Ourak (KU Leuven, BE); Emmanuel Benjamin Vander Poorten (KU Leuven, BE)*

11:40

Discrete bistable-actuated catheter*Emmanuel Benjamin Vander Poorten, Julie Legrand (KU Leuven, BE); Mouloud Ourak (KU Leuven, BE)*

12:00

A manually actuated continuum robot research platform for deployable shape-memory curved cannula stereotactic neurosurgery*Julian Mühlenhoff, Thorben Körbner, Yunhao Xiao (TU Ilmenau, DE); Giovanni Miccoli, Dörthe Keiner (Universitätsklinikum Des Saarlandes, DE); Kathrin Flaßkamp (Universität Des Saarlandes, DE); Karl Worthmann (TU Ilmenau, DE); Joachim Oertel (Universitätsklinikum Des Saarlandes, DE); Thomas Sattel (Ilmenau University of Technology, DE)***12:20 - 13:50 Lunch Break**

Gustav Mahler Saal II

B1	Polymer Actuators <i>Chairs: Aaron Price (Western University, CA); Markus Henke (Technische Universität Dresden, DE)</i>
11:00	Interactive morphing surface - Arrays of self-sensing and touch-sensitive soft polymer actuators <i>Jonas D. Heldt (Fraunhofer Institute for Manufacturing Engineering and Automation, DE); Ivica Kolaric (Fraunhofer & Fraunhofer IPA, DE); Julian Stuebing (& Fraunhofer IPA, DE)</i>
11:20	Boron-based magnetoactive Polymers - the new smart material <i>Gareth Monkman (OTH Regensburg, DE)</i>
11:40	Continuous, highly efficient production of twisted monofilaments for twisted coiled polymer actuators <i>Johannes Mersch (Technische Universität Dresden, DE); Nicholas Witham (University of Utah, USA); Markus Koenigsdorff (Technische Universität Dresden, DE); Florian Solzbacher (University of Utah, USA); Gerald Gerlach (Technische Universität Dresden, DE)</i>
12:00	Design of Electrical Contact for DE Transducers under Thermal Considerations <i>Michael J. Gareis, Ozan Çabuk, Jürgen Maas (Technische Universität Berlin, DE)</i>

Gustav Mahler Saal III

C1	Optics <i>Chairs: Barkan Ugurlu (Ozyegin University, TR); André Preumont (Université libre de Bruxelles, BE)</i>
11:00	Fabrication of Micro Halbach Arrays in a Monolithic Ring Magnet by Laser-Assisted Heating Magnetization <i>Keita Nagai, Youhei Hamaoka (Tokyo Institute of Technology, JP); Naohiro Sugita (Tokyo Institute of Technology, JP); Tadahiko Shinshi (Tokyo Institute of Technology, JP)</i>
11:20	Concept for an SMA-Actuated Camera Gimbal <i>Alexander Schwegler (Beethovenstr. 1 & Hochschule Aalen, DE); Arif Kazi (Aalen University of Applied Sciences, DE); Tobias Schumm, Markus Koepfer (Actuator Solutions GmbH, DE)</i>
11:40	Development of a SMA driven articulation and autofocus mechanism for endoscope applications <i>Rouven Britz, Michele Mandolino (Saarland University, DE); Yannik Goergen (ZeMA gGmbH & Saarland University, DE); Gianluca Rizzello (Saarland University, DE); Paul Motzki (ZeMA gGmbH & Saarland University, DE)</i>
12:00	P-FSM150S Fast Steering Mirror for Optical Space Constellations <i>Gerald Aigouy, Etienne Betsch (Cedrat Technologies, FR); Frank Claeysen (CEDRAT Technologies S.A., FR); Adrien Guignabert, Hugo Gardel, Augustin Bedek, Anthony Baillus, Nicolas Bourgeot, Pierre Personnat (Cedrat Technologies, FR)</i>

12:20 - 13:50 Lunch Break

*Gustav Mahler Saal I***A2 Microfluidic Handling / Energy Harvester***Chairs: Ulrike Wallrabe (Albert-Ludwigs-Universität Freiburg, DE); Jérôme Perret (Haption GmbH, DE)***13:50 A Disposable Electromagnetic Micropump for Oscillatory-flow PCR Microfluidic System***Chao Qi, Naohiro Sugita, Tadahiko Shinshi (Tokyo Institute of Technology, JP)***14:10 Development of a Lightweight, Compact and Energy Efficient Pinch Valve driven by Shape Memory Alloy Wires***Dominik Scholtes (ZeMA gGmbH, DE); Yannik Goergen (ZeMA gGmbH & Saarland University, DE); Rouven Britz (Saarland University, DE); Paul Motzki (ZeMA gGmbH & Saarland University, DE)***14:30 Media-separated micropump consisting of magnetic shape memory alloy actuator***Tim Polley (HNP Mikrosysteme GmbH, DE)***14:50 The energy harvesting system by using internal acoustic energy at both side excitation***M. Tsuchiya, H. Tsuchiya, Hiroyuki Moriyama, H. T. Uchida, Soshi Nagasaka, Yuto Suzuki (Tokai University, JP)**Gustav Mahler Saal II***B2 Electromagnetic Actuators / Magnetostrictive Actuators***Chairs: Wolfgang Amrhein (ACCM GmbH, AT); Roland Keller (Dr. Fritz Faulhaber GmbH & Co. KG, DE)***13:50 Self-sensing Giant Magnetostrictive Actuator with Real-time Detection of Mechanical Stress***Dongjian Xie, Yikun Yang, Bintang Yang (Shanghai Jiao Tong University, CN)***14:10 Development of a magnetic reluctance force actuator for chatter suppression in boring bars***Fagher Alam Wahab (& IDEKO S. COOP, ES)***14:30 Design and investigation of a miniaturized tubular electrical linear motor***Bela Schulte Westhoff, Jürgen Maas (Technische Universität Berlin, DE)***14:50 A Comparison of Linear and Circular Force Inertial Actuation***Larry D Ridge (GHSP, USA); Mark Norris, Stefan Barbulescu (Parker Lord, USA); Brad Sanderson (GHSP, USA)***15:10 - 16:00 Coffee Break**

*Gustav Mahler Saal III***C2 Aerospace**

Chairs: Frank Claeysen (CEDRAT Technologies S.A., FR); Hans Peter Monner (German Aerospace Center (DLR), DE)

13:50

High power density Piezo motors for critical environments

Nabil Bencheikh, Alexandre Pagès, Etienne Betsch, Jolan Gauthier (Cedrat Technologies, FR)

14:10

SYNJET3C Improvement of Synthetic Jet Actuator Technology for High Efficiency

Gerald Aigouy, Arnaud Barnique (Cedrat Technologies, FR); Frank Claeysen (CEDRAT Technologies S.A., FR); Frederic Ternoy (Onera, FR); Martin Schueller (Trisitec, DE); Eberhard Kaulfersch (Fraunhofer Institute for Electronic Nano Systems, DE)

14:30

Modelling and verification of Shape Memory Alloy (SMA) based Morphing Actuators

Christoph Dünn (FGW Forschungsgemeinschaft Werkzeuge Und Werkstoffe E. V., DE); Manuel Kunzler (Leibniz-Institut Für Verbundwerkstoffe, DE); Max Kaiser (Institut für Verbundwerkstoffe, DE); Romina Krieg (FGW Forschungsgemeinschaft Werkzeuge Und Werkstoffe E. V., DE); Ralf Theiß, Peter Dültgen (Forschungsgemeinschaft Werkzeuge und Werkstoffe, DE); Martin Gurka (Leibniz-Institut Für Verbundwerkstoffe, DE)

14:50

Bio-Inspired Flapping Wing Antagonist Actuation with SMA Wires

Domenico Bevilacqua (Saarland University & ZeMA GmbH, DE); Giovanni Soletti (Politecnico di Bari, IT); Gianluca Rizzello (Saarland University, DE); Paul Motzki (ZeMA gGmbH & Saarland University, DE)

15:10 - 16:00 Coffee Break

Gustav Mahler Saal I

A3 Robotics
Chairs: Pierre Renaud (University of Strasbourg, FR); Emmanuel Benjamin Vander Poorten (KU Leuven, BE)

16:00 **Highly dynamic robotic leg for non-biomimetic walking robots**
Jan Baumgärtner (Zentrales Institut Für Informatik, Universität Heidelberg, DE); Johannes Bach (Institut Für Medizingerätetechnik, Universität Stuttgart, DE); Lorenzo Masia (Zentrales Institut Für Informatik, Universität Heidelberg, DE); Essameddin Badreddin (Institute for Computer Engineering, University of Heidelberg, DE); Peter P. Pott (Universität Stuttgart, DE)

16:20 **A Servomotor with Adjustable Stiffness for Humanoid Robotics Application**
Michele Folgheraiter, Sharafatdin Yessirkepov, Timur Umurzakov (Nazarbayev University, KZ)

16:40 **Design and Parameter Identification of a Soft Robotic bendable module with Artificial Muscle Fibers**
Matthias Baltes, Johannes Pechtl (Saarland University, DE); Julian Kunze (Saarland University & ZeMA, DE); Gianluca Rizzello (Saarland University, DE)

17:00 **Anisotropic Carbon Fibre Electrodes for Dielectric Elastomer Actuators**
Markus Koenigsdorff, Johannes Mersch, Sascha Pfeil, Mathis Bruns, Gerald Gerlach (Technische Universität Dresden, DE)

Gustav Mahler Saal II

B3 Actuators Based on ER/MR Fluids
Chairs: Janusz Goldasz (BWI Group, Technical Center Krakow, PL); Jürgen Maas (Technische Universität Berlin, DE)

16:00 **A compact 4-DoF MR damper with independent damping adjustment**
Aditya Suryadi Tan, Fabian Rabel, Yannick Sill (Technische Universität Ilmenau, DE); Thomas Sattel (Ilmenau University of Technology, DE)

16:20 **The transient response of magnetorheological actuator/ fluid in shear mode on the rapid change of magnetic field: effect of shear rate**
Josef Válek, Michal Kubík, Ondrej Machacek, Zbyněk Strecker (Brno University of Technology, CZ)

16:40 **Development of a precisely controlled MRF-brake for medical ergometers**
Lukas Masjosthusmann, Valentin Schreiner (Technical University Berlin, DE); Julian Tschersich, Frank Baumann (Maschinenfabrik Mönninghoff GmbH Co. KG, DE); Lutz Neumann (Ergoline GmbH, DE); Jürgen Maas (Technische Universität Berlin, DE)

17:00 **Online rotor balancing by weight spheres controlled by MRF**
Valentin Schreiner (Technical University Berlin, DE); Jürgen Maas (Technische Universität Berlin, DE)

18:30-21:00 Get Together

*Gustav Mahler Saal III***C3 Industrial Applications**

Chairs: Peter Krippner (Bürkert Werke GmbH & Co. KG, DE); Hans-Jürgen Karkosch (Contitech Vibration Control GmbH, DE)

16:00 **Moving iron controllable actuator MICA20CS Proof Mass Actuator**
Gerald Aigouy, Xavier De Lepine, Patrick Meneroud, Steven Rowe, Aurore Piéton, Théo Simon, Marc Fournier, Olivier Sosnicki (Cedrat Technologies, FR); Frank Claeysen (CEDRAT Technologies S.A., FR)

16:20 **High performance four-quadrant actuator**
Wolfgang Zoels, Georg Bachmaier, Christopher McClanahan (MetisMotion GmbH, DE)

16:40 **Mechatronic piezo mechanisms for active vibration control**
Steven Rowe, Jolan Gauthier, Alexandre Pagès, Jean-Marc Nwesaty (Cedrat Technologies, FR)

17:00 **Beyond Actuator Limits: Overcoming a Wide Range of Requirements in Warp Knitting Machines with Modular Actuator Systems**
Florian Hoppe, Georg Kraus, Christian Arnold (KARL MAYER STOLL R&D GmbH, DE)

18:30-21:00 **Get Together**

Plenary Talks

Chairs: Stefan Seelecke (Saarland University, Saarbrücken, DE); Emmanuel Benjamin Vander Poorten (KU Leuven, BE)

09:00 **Recent advances in magnetic shape memory material and device technologies**

Markus Laufenberg, Emmanouel Pagounis (ETO MAGNETIC GmbH, DE)

09:30 **Fast & fine Steering Mirrors based on piezoelectric & magnetic actuator technologies for Air & Space**

Frank Claeysen (CEDRAT Technologies S.A., FR)

10:00 **Advances in the dynamics of MR actuators**

Zbyněk Strecker (Brno University of Technology, CZ)

10:30 - 11:00 Coffee Break*Gustav Mahler Saal I***A4 SMA (1)**

Chairs: Luigi Manfredi (University of Dundee, United Kingdom (GB)); Giorgio Vergani (SAES Getters S.p.A., IT)

11:00 **Evaluation of efficient and lifetime optimised SMA actuation strategies**

Christoph Dünn, Romina Krieg (FGW Forschungsgemeinschaft Werkzeuge Und Werkstoffe E. V., DE); Ralf Theiß, Peter Dültgen (Forschungsgemeinschaft Werkzeuge und Werkstoffe, DE)

11:20 **Fatigue behavior of Shape Memory Alloy wires actuated at high speed**

Marco Citro, Salvatore Coco (Saes Getters, IT)

11:40 **Inverted Pendulum-Type SMA Actuator**

Arif Kazi (Aalen University of Applied Sciences, DE); Markus Bäuml, Markus Koepfer (Actuator Solutions GmbH, DE); Tobias Ehrmann (Aalen University of Applied Sciences, DE)

12:00 **Analysis of the impact of mechanical guidance on active MSM-stick elongation behavior**

Marco Hutter, Bernd Gundelsweiler (University of Stuttgart, DE)

12:20 **Enhancing the dynamics of SMA actuators by using latent heat**

Roland Binninger, Daniel Schwarz (Fraunhofer IPM, DE); Daniel Maiwald, André Bucht (Fraunhofer IWU, DE); Christian Weck (Fraunhofer IFAM, DE); Kilian Bartholomé, Olaf Schäfer-Welsen (Fraunhofer IPM, DE)

12:40 - 13:40 Lunch Break

Gustav Mahler Saal II

- B4 Actuator Control and Electronics**
Chairs: Jürgen Maas (Technische Universität Berlin, DE); Waldemar Spomer (Physik Instrumente (PI) GmbH & Co. KG, DE)
- 11:00 **Intelligent force-controlled miniature gripper driven by magnetic shape memory alloy**
Julius Happel, René Schnetzler, Markus Laufenberg (ETO MAGNETIC GmbH, DE)
- 11:20 **Deep Reinforcement Learning for Model-free Sensorless Speed Control of Ultrasonic Motors**
Abdullah M Mustafa, Tatsuki Sasamura, Takeshi Morita (The University of Tokyo, JP)
- 11:40 **Small and scalable high voltage push-pull converter for feeding dielectric elastomer transducers (DET)**
Samuel Junglas, Andreas Hubracht (Technical University of Berlin, DE); Jürgen Maas (Technische Universität Berlin, DE)
- 12:00 **Efficient Driving Method for Piezoelectric Inertia Motors**
Burhanettin Koc (Physik Instrumente (PI) GmbH & Co. KG, DE); Sebastian Kist, Ammar Hamada (Physik Instrumente (PI), DE)
- 12:20 **A Planar Single-Actuator Bi-Stable Mechanical/Electrical Switch**
Shuangwen Xie (Tsinghua University, CN); Ruizi Liu (The Hong Kong University of Science and Technology, CN); Shuya Okayama, Toshiyuki Tsuchiya (Kyoto University, JP); Man Wong (The Hong Kong University of Science and Technology, Hong Kong); Xiaohong Wang (Tsinghua University, CN)

Gustav Mahler Saal III

- C4 KOMMMA Session (1)**
Chairs: Manfred Kohl (Karlsruher Institut für Technologie (KIT), DE); Stefan Seelecke (Saarland University, Saarbrücken, DE)
- 11:00 **Design of an Liquid Dielectrophoresis driven Platform with Cooperative Actuation**
Peter Conrad (Ruhr-Universität Bochum, DE)
- 11:15 **A thermomechanically fully coupled finite strain shape memory alloy model applied to bistable microactuators**
Marian Sielenkämper (Christian-Albrechts-Universität zu Kiel, DE)
- 11:30 **Development of Bimorph and Trimorph Microactuators Based on TiNiHf Thin Film and Si Technology**
Gowtham Arivanandhan (Karlsruhe Institute of Technology, DE)
- 11:45 **Study of the Dynamic Behavior of an Electrostatic Actuation Unit Cell for a Cooperative, Bidirectional Inchworm Motor: Design, Fabrication and Characterization**
Almothana Albukhari (Furtwangen University & University of Freiburg, DE); Ulrich M Mescheder (Hochschule Furtwangen, DE)
- 12:00 **Modeling and Parameter Study of a Cooperative Flexible Array of Dielectric Elastomer Actuators**
Sipontina Croce (Saarland University, DE)
- 12:15 **Design and Characterization of a Fully Polymeric and Flexible Array of Coupled Dielectric Elastomer Actuators**
Julian Neu (Saarland University, DE)

12:40 - 13:40 Lunch Break

Poster Session

P1	Various topics on actuators
P1.1	Investigations of high load actuators based on Shape Memory Alloys <i>Andrea Böhm (Fraunhofer-Institut für Werkzeugmaschinen und Umformtechnik, DE); Daniel Maiwald, Kenny Pagel (Fraunhofer IWU, DE); Welf-Guntram Drossel (Fraunhofer Institute for Machine Tools and Forming Technology IWU, DE)</i>
P1.2	Design of a pinch mode magnetorheological flow bench: magnetic field analysis <i>Michal Kubík (Brno University of Technology, CZ); Janusz Goldasz (BWI Group, Technical Center Krakow, PL); Ondrej Machacek (Brno University of Technology, CZ); Bogdan Sapiński (AGH University of Science and Technology, PL)</i>
P1.3	Dielectric elastomer stack actuator module with integrated electronics and encapsulation <i>Tobias Pointner, Metin Giousouf (Festo SE & Co. KG, DE); Michael Wegener, Silvia Janietz (Fraunhofer IAP, DE); Selina Gomoll, Antonia Hoppe, Christian Splith (FEW Chemicals GmbH, DE)</i>
P1.4	Development of an application-oriented Design Tool for Multilayer Stack Actuators based on Dielectric Elastomer Materials <i>Jana Mertens (Technical University of Berlin, DE); Jürgen Maas (Technische Universität Berlin, DE)</i>
P1.5	Effect of Heat Treatment and Hydrogen Solution on the Elastic Properties of Titanium <i>H. T. Uchida, Takaya Sato, Hironori Odaka, Kenta Watanabe, A. Kaneko, Yufeng Sun, H. Tsuchiya, Yoshihito Matsumura, A. Toneyawa (Tokai University, JP)</i>
P1.6	Hand-held Device for Force Estimation during Tool Tissue Interaction <i>Juliane Mayer, Max B. Schäfer, Jan Liu, Giuliano Antonio Giacoppo (University of Stuttgart, DE); Timo Markert (Wittenstein SE, DE); Sebastian Matich (Technische Universität Darmstadt, DE); Peter P. Pott (Universität Stuttgart, DE)</i>
P1.7	Influence of a fixed twisting zone on a Twisted String Actuation <i>Giuliano Antonio Giacoppo, Johannes Meiringer, Max B. Schäfer, Michael da Silva, Lars Finke (University of Stuttgart, DE); Peter P. Pott (Universität Stuttgart, DE)</i>
P1.8	Magnetically hybridized inkjet-printed und UV-polymerized multi-hydrogel thermal responsive soft gripper <i>Alexander Kutscher (TU Dresden, DE)</i>

15:10 - 15:30 Coffee Break

Poster Session

P2	Electromagnetic actuators
P2.1	Influence of Shaft Material Magnetic Characteristics on Electromagnetic Actuator <i>Eray Humali (Roketsan Missiles Inc. & Istanbul Technical University, TR)</i>
P2.2	Pole Pitch Optimization of a Flux Switching Permanent Magnet Linear Machine for Small Scale Wave Energy Harvesting <i>Julius Harms, Thorsten A Kern (Hamburg University of Technology, DE)</i>
P2.3	Compact and lightweight linear actuator for handheld medical robotic devices <i>Ralf Gundling (Medical Faculty Mannheim, University Heidelberg, DE); Peter P. Pott (Universität Stuttgart, DE); Markus Schwarz (Medical Faculty Mannheim, University Heidelberg, DE)</i>
P2.4	Static Pull-in Effect of Hybrid Levitation Micro-actuators for Square-Shaped Proof Mass <i>Chun Him Lee (Karlsruhe Institute of Technology, DE); Sreejith Sasi Kumar (Institute of Microstructure Technology, DE); Emil R. Mamleyev (Karlsruhe Institute of Technology, DE); Kirill Poletkin (Karlsruher Institut für Technologie (KIT), DE)</i>
P2.5	Calculation of mutual inductance between circular and arbitrary shaped filaments: Segmentation Method <i>Sreejith Sasi Kumar (Institute of Microstructure Technology, DE); Chun Him Lee, Emil R. Mamleyev (Karlsruhe Institute of Technology, DE); Kirill Poletkin (Karlsruher Institut für Technologie (KIT), DE)</i>
P2.6	Multi-Domain Design of an Actuator System for Wearable Application in Clothing <i>Folke Schwinning, Thorsten A Kern (Hamburg University of Technology, DE)</i>

Poster Session

P3	Micro / nano manipulation and positioning
P3.1	Directional Behavior of Periodic Honeycombs: towards Lightweight MEMS on SOI Wafers <i>Anna Christina Thewes (Ruhr Universität Bochum & Fakultät für Elektrotechnik und Informationstechnik, DE); Melvin Jondral, Martin Hoffmann (Ruhr-Universität Bochum, DE)</i>
P3.2	Optimization of Electrostatic Bending-Plate Actuators: Increasing the Displacement and Adjusting the Actuator Stiffness <i>Lisa Schmitt, Martin Hoffmann (Ruhr-Universität Bochum, DE)</i>
P3.3	How to reduce the Pull-in Displacement of Parallel-Plate Actuators <i>Philip Schmitt (Ruhr University Bochum, DE); Martin Hoffmann (Ruhr-Universität Bochum, DE)</i>

15:10 - 15:30 Coffee Break

Poster Session**P4 Piezoelectric actuators / piezoelectric motors**

- P4.1 **Electromechanical Model for Biphasic Piezo Inertia Drive**
Buelent Delibas, Burhanettin Koc (Physik Instrumente (PI) GmbH & Co. KG, DE)
-
- P4.2 **Disc type piezoelectric actuator for optical lens positioning**
Dalius Mazeika (Vilnius Gediminas Technical University, LT); Piotr Vasiljev (Vytautas Magnus University, LT); Ying Yang (Nanjing University of Aeronautics and Astronautics, CN); Andrius Ceponis (Vilnius Gediminas Technical University, LT); Regimantas Bareikis, Arunas Struckas (Vytautas Magnus University, LT); Sergejus Borodinas (Vilnius Gediminas Technical University, LT)
-
- P4.3 **Ultrasonic Actuator-Driven Medical Fluid Pump**
Alexej Wischnewski (Physik Instrumente (PI) & GmbH & Co KG, DE)
-
- P4.4 **Design of a 2-phase Piezoelectric Inertia Drive Type Motor**
Burhanettin Koc, Buelent Delibas (Physik Instrumente (PI) GmbH & Co. KG, DE)
-
- P4.5 **A Microchannel Device for Droplet Classification by Manipulation using Piezoelectric Vibrator**
Takefumi Kanda, Shoko Seo, Yoshiki Ohara, Shuichi Wakimoto (Okayama University, JP)
-
- P4.6 **Experimental characterization of a piezoelectrically actuated force amplifier using optical and self-sensing methods**
Sonja Müller and Ulrich M Mescheder (Hochschule Furtwangen, DE)

Poster Session**P5 Process engineering**

- P5.1 **A New Simple Method for Detecting Biofilms Using Heatable Capacitive Sensor Structures (CSS)**
Kai-Uwe Zirk, Markus Kemper, Christoph Kolhoff, Patrick Dummeier (University of Applied Science Diepholz, DE); Manuel Olze (Plümat, Plate & Lübeck GmbH & Co, DE); Harald Pötzschke (Freelancer, DE)
-
- P5.2 **A New Method to Monitoring the Curing of Filler Educts in Fibre Composites**
Kai-Uwe Zirk, Markus Kemper, Christoph Kolhoff (University of Applied Science Diepholz, DE); Harald Pötzschke (Freelancer, DE)
-
- P5.3 **FEM-assisted design of multi-purpose printed-circuit sensor structures**
Patrick Dummeier, Kai-Uwe Zirk (University of Applied Science Diepholz, DE); Harald Pötzschke (Freelancer, DE)

15:10 - 15:30 Coffee Break

*Poster Session***P6 Robotics / micro robotics / soft robotics**

- P6.1 **Thermosensitive elastomers for shape adaption of soft robotic systems**
Nina Prem (OTH Regensburg, DE); Klaus Zimmermann (TU Ilmenau, DE)
-
- P6.2 **Design of a Series Elastic Actuator for an Assistive Exoskeleton using Numerical Methods and Gait Data**
Sander De Groof (KU Leuven, BE); Yang Zhang (JUNIA-HEI, FR); Peyrodie Laurent (JUNIA, FR); Roy Sevit (Thomas More University of Applied Sciences, BE); Emmanuel Benjamin Vander Poorten (KU Leuven, BE); Erwin Aertbeliën (Katholieke Universiteit Leuven, BE); Luc Labey (KU Leuven, BE)
-
- P6.3 **A Hybrid Compact Control Unit for a Soft Colonoscope**
Luigi Manfredi (University of Dundee, United Kingdom (GB))
-
- P6.4 **Design and Development of a Torsion-based Series Elastic Actuator with Nested Encoders for a Wearable Exoskeleton Robot**
Alihan Kuru, Ozkan Bebek, Barkan Ugurlu (Ozyegin University, TR)
-
- P6.5 **Topology Optimization-based Design and Development of a Compact Actuator with a High Torque-to-Weight Ratio for Quadrupeds**
Sinan Emre, Baris Akin, Erim Can Ozcinar, Baris Balci, Polat Sendur, Ozkan Bebek, Ramazan Unal, Barkan Ugurlu (Ozyegin University, TR)
-
- P6.6 **Improvement of pneumatically driven prosthetic hand for use in daily life**
Ren Yakami, Hironari Taniguchi (Osaka Institute of Technology, JP); Shuichi Wakimoto (Okayama University, JP); Kosuke Morinaga (Hiroshima International University, JP)
-

15:10 - 15:30 Coffee Break

*Gustav Mahler Saal I***A5 SMA (2)***Chairs: Emmanouel Pagounis (ETO MAGNETIC GmbH, DE); Joost Lötters (Bronkhorst High-Tech B.V., NL)*

15:30 **Fully coupled simulation of magnetic shape memory alloys under elongating and contracting perpendicular magnetic fields**

Robert Courant (Technical University of Berlin, DE); Jürgen Maas (Technische Universität Berlin, DE)

15:50 **Development of Rotatory Decoupled Antagonistic SMA Actuator**

Tom Gorges (Center for Mechatronics and Automation Technology - ZeMA gGmbH & University of Applied Sciences - HTW Saar, DE); Philipp Molitor (ZeMA gGmbH, DE); Rouven Britz (Saarland University, DE); Paul Motzki (ZeMA gGmbH & Saarland University, DE)

16:10 **High-Power and High-Speed SMA Bowling Ball Demonstrator**

Philipp Molitor (ZeMA gGmbH, DE); Rouven Britz (Saarland University, DE); Paul Motzki (ZeMA gGmbH & Saarland University, DE)

16:30 **A Thermal Energy Harvester Based on Bistable SMA Microactuation**

Xi Chen (Karlsruher Institut für Technologie, DE); Lars Bumke (Kiel University, DE); Eckhard Quandt (Christian-Albrechts-Universität zu Kiel, DE); Manfred Kohl (Karlsruher Institut für Technologie (KIT), DE)

16:50 **Miniature Shock Absorber Based on SMA Foil Actuation**

*Kiran Jacob (Karlsruhe Institute of Technology, DE); Nicholas Case (KIT, DE); Shuichi Miyazaki (University of Tsukuba, JP); Manfred Kohl (Karlsruher Institut für Technologie (KIT), DE)**Gustav Mahler Saal II***B5 Piezoelectric Actuators***Chairs: Patrick Pertsch (PI Ceramic GmbH, DE); Kenji Uchino (The Pennsylvania State University, USA)*

15:30 **Thermal characterization of passive piezoelectric actuators**

Xenia Y. Ratke (Technische Universität Ilmenau, DE); Thomas Sattel (Ilmenau University of Technology, DE)

15:50 **Microscale Single Crystal Ultrasonic Actuator for Miniature Optical Systems**

Maxim Wischnewski (Physik Instrumente (PI) GmbH & Co. KG); Alexej Wischnewski (Physik Instrumente (PI) & GmbH & Co KG, DE); Buelent Delibas (Physik Instrumente (PI) GmbH & Co. KG, DE); Patrick Pertsch (PI Ceramic GmbH, DE)

16:10 **Expansion of Driving Frequency and Voltage Amplitude Limits and Suppression of Dynamic Characteristic Variations of Piezoelectric Stacked Actuators by Forced Liquid Cooling with Silicon Oil**

Rina Nishida, Jianpeng Zhong, Tadahiko Shinshi (Tokyo Institute of Technology, JP)

16:30 **Effect of rotor elasticity on driving characteristics of the ultrasonic motors**

Tatsuki Sasamura, Abdullah M Mustafa, Susumu Miyake (The University of Tokyo, JP); Norio Sashida (Shinsei Corporation, JP); Takeshi Morita (The University of Tokyo, JP)

16:50 **Self-sensing damping control for mechanically coupled piezo actuators**

*Bas Jansen (Eindhoven University of Technology & ASML, NL); Aditya Ananthkrishnan, Hans Butler (Eindhoven University of Technology, NL); Siep Weiland (Technische Universiteit Eindhoven, NL)***17:10 - 17:20 Closing Remarks**

*Gustav Mahler Saal III***C5 KOMMMA Session (2)**

Chairs: Manfred Kohl (Karlsruher Institut für Technologie (KIT), DE); Ulrike Wallrabe (Albert-Ludwigs-Universität Freiburg, DE)

- 15:30 **Microstructured Stimuli Responsive Hydrogel Actuators**
Tobias Spratte (Universitätsklinikum Heidelberg, DE)
-
- 15:45 **Model Order Reduction of a Nonlinear Electromechanical Beam Actuator by Clustering Input-Nonlinearities**
Arwed Schütz (Jade University of Applied Sciences, DE)
-
- 16:00 **Kick & Catch: Coaction of an electrostatic kick and magnetic catch system for the rotation of a sphere**
Mario Farny (Ruhr-Universität Bochum, DE) Mo
-
- 16:15 **Antagonistic SMA Film Actuators for Folding and Unfolding of Origami-Type Microstructures**
Georgino Kaleng Tshikwand (University of Erlangen-Nuremberg, DE)
-
- 16:30 **Reduction of the Solenoid Micro-Coil Size as a Path to Transporter Micro-Actuator Array**
Emil R. Mamleyev (Karlsruhe Institute of Technology, DE); Kirill Poletkin (Karlsruher Institut für Technologie (KIT), DE)
-
- 16:45 **Calculation of magnetic force between two circular filaments arbitrary oriented in the space by using method of mutual inductance**
Kirill Poletkin (Karlsruher Institut für Technologie (KIT), DE)
-

17:10 - Closing Remarks

17:20 *Chairs: Helmut F. Schlaak (Technical University Darmstadt, DE)*

General Information

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Conference Fees

(The conference fee includes admission to all sessions as well as to the Conference Proceedings)

	Early Bird Registration by May 28, 2022	Registration after May 28, 2022
Full Ticket	900,- €	1000,- €
VDE/VDI Members	800,- €	900,- €
Authors	550,- €	650,- €
Steering Committee Members	550,- €	650,- €
Students *	450,- €	550,- €

* Discount for students only with a student certificate valid at the time of the event

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Conference Venue

Congress Center Rosengarten
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Training Sessions CEDRAT TECHNOLOGIES

Attend the 1-day training performed on June 28th by Cedrat Technologies (CTEC), as joint event to ACTUATOR 2022

The courses are opened to engineers, PhD students and technicians willing to have a first knowledge either on piezo OR on linear actuators. As these training courses are not part of the conference ACTUATOR 2022, a separate registration is required (550 €).

Should you be interested in attending one session feel free to contact CTEC at training.ct@cedrat-tec.com or by phone +33 (0)4 56 58 04 14 (asking for Ms Hugi Sandrine).



Conference Information

Exhibition

The **12th International Exhibition on Smart Actuators and Drive Systems** will present components, system approaches and applications of smart actuators and low-power electromagnetic drives based on conventional (electromagnetic) and innovative working principles (new actuators), and associated subjects. The range of topics also includes measurement techniques, control concepts and circuits, driver components and units, system integration, layout and simulation tools etc.

Within the online exhibition area, we will again have application oriented presentations on a product level, besides the in-depth conference programme. This Exhibition Forum provides additional information about the exhibition topics on the product level especially to visitors of the exhibition. Exhibitors and other parties are therefore invited to show contributions and demonstrate their products.

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