

ACTUATOR 2002

**8th International Conference on New Actuators
&
2nd International Exhibition on Smart Actuators
and Drive Systems**

**10 – 12 June 2002
Bremen, Germany**

Conference Proceedings

Editor

Hubert Borgmann

Published by

MESSE BREMEN GMBH, Bremen, Germany

© 2002 MESSE BREMEN GMBH, Bremen, Germany

No responsibility is assumed by the publisher for any injury and/or damage to persons or property with regard to products liability, negligence or otherwise, resulting from any use or operation of the methods, products, instructions or ideas contained in the material herein.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means (electronic, mechanical, photocopying) or otherwise, without the prior written permission of the publisher.

Printed in Germany by Schintz-Druck GmbH, Bremen
ISBN-3-933339-05-7

8th International Conference on New Actuators
2nd International Exhibition on Smart Actuators and Drive Systems

ACTUATOR 2002

10 – 12 June, 2002
Bremen Fair and
Congress Center,
Germany

Organised by

MESSE BREMEN GMBH, Bremen, Germany

Endorsements

American Ceramic Society, USA

German Electrical and Electronic Manufacturers' Association (ZVEI), Germany
Division Electronic Components

German Machinery and Plant Manufacturers Association (VDMA), Germany
Fluid Power Transmission and Control Association

Japan Technology Transfer Association, Japan

The Association of Engineers (VDI), Germany

The Senator of Economy and Ports
Ministry of Federal State of Bremen, Germany

The Society of Non-Traditional Technology, Japan

University of Bremen, Germany

VDI/VDE-Technologiezentrum Informationstechnik GmbH
(VDI/VDE-IT), Germany

Committee

J. D. Carlson
Lord Corporation, Cary, NC, USA

F. Claeysen
Cedrat Technologies, Meylan, France

T. Geßner
Technische Universität Chemnitz, Germany

K. Hameyer
Katholieke Universiteit Leuven, Heverlee, Belgium

H.-J. Karkosch
ContiTech Vibration Control GmbH, Hannover, Germany

V. Klocke
Klocke Nanotechnik GmbH, Aachen, Germany

R. D. Kornbluh
SRI International, Menlo Park, CA, USA

H. Löwe
Institut für Mikrotechnik Mainz GmbH, Germany

K. Lubitz
Siemens AG, München, Germany

M. Nienhaus
Mymotors & Actuators, Wendelsheim, Germany

A. Preumont
Université Libre de Bruxelles, Belgium

E. Quandt
Caesar, Bonn, Germany

P. Sommer-Larsen
Risø National Laboratory, Roskilde, Denmark

K. Spanner
Physik Instrumente GmbH & Co., Karlsruhe, Germany

J. L. Sproston
The University of Liverpool, United Kingdom

K. Uchino
The Pennsylvania State University, PA, USA

K. Ullakko
AdaptaMat Ltd., Helsinki, Finland

M. Wuttig
University of Maryland, MD, USA

Organiser

H. Borgmann
MESSE BREMEN GMBH, Germany

Welcoming Remarks

Welcome to ACTUATOR 2002 in Bremen. This event continues the series of biennial functions in Bremen and consists of the *8th International Conference on New Actuators* and the *2nd International Exhibition on Smart Actuators and Drive Systems*. Like its predecessors, ACTUATOR 2002 is a major meeting place for leading experts, scientists and managers from all over the world in the field of new actuators. Its main focus is on the trans-fer of new results from science and research into wide fields of application.

Based on the very positive response to last event, we have extended our concept of two parallel tracks of oral presentations offering a wide range of application-oriented topics such as aerospace applications, nanopositioning/nanomanipulation, microfluidics, vibration control and medical applications in additional conference sessions besides the technical sessions. In addition, we have also enlarged the technical area, now including electroactive polymers in a separate session for the first time.

Of course, the schedule has again been compiled carefully to avoid time conflicts between related topics. Thus, we will have in total 80 oral presentations and 71 poster contributions this time, all portraying the state of the art and indicating future trends.

Oral sessions will be held in the following fields:

Piezoelectric actuators	Aeronautical/aerospace applications
Micro actuators	Medical applications
Magnetostrictive actuators	Microfluidics
ERF/MRF actuators	Nanopositioning/nanomanipulation
Shape memory actuators	Piezoelectric actuators: applications
Electromagnetic actuators	Vibration control
Polymer actuators	

With one exception, all these sessions will be kicked off by a 30-minute review, normally presented by a member of the Programme Committee, followed by application-oriented presentations of 20 minutes each. The full manuscripts of nearly all oral papers and poster contributions have again been included in these proceedings and in a separate CD-ROM.

Furthermore, we invite you to also visit the accompanying trade show steadily growing from event to event. In the exhibition forum right in its centre, exhibitors will again give more product-oriented presentations. Thus, conference participants and visitors to the exhibition can inform themselves individually about the current state of actuator technology and the performance of available products.

Our special thanks go to all those participants who are actively contributing to this event by sharing the results of their research work here – as authors of papers and posters, or as exhibitors – and thus possibly igniting new projects, initiating new cooperations, or paving the way for new business connections. We also thank the members of the Programme Committee for their excellent work and valuable assistance, and we are particularly grateful to the endorsing institutions and to all others who have supported our public relations work.

We are looking forward to interesting presentations, lively discussions and helpful new contacts, and we would be pleased to welcome you at this place again in two years, for ACTUATOR 2004.

Enjoy your conference!


Hans Peter Schneider
MESSE BREMEN GMBH
General Manager


Hubert Borgmann
MESSE BREMEN GMBH
Organiser ACTUATOR

Table of Contents

	No	Page
Oral Contributions		
Sessions A		
Piezoelectric Actuators I	A1.0 - A1.6	8
Shape Memory Actuators	A2.0 - A2.5	9
Nanopositioning/Nanomanipulation	A3.0 - A3.4	10
Piezoelectric Actuators II: Applications	A4.0 - A4.7	11
Magnetostrictive Actuators	A5.0 - A5.4	12
Low-Power Electromagnetic Actuators	A6.0 - A6.8	13
Sessions B		
Microfluidics	B1.0 - B1.6	15
Vibration Control	B2.0 - B2.5	16
Aeronautical/Aerospace Applications	B3.0 - B3.4	17
Micro Actuators	B4.0 - B4.7	18
ERF-/MRF Actuators	B5.0 - B5.4	19
Medical Applications	B6.1 - B6.4	20
Polymer Actuators	B7.0 - B7.4	21
Poster Contributions		
Piezoelectric Actuators	P1 - P29, P83	22
Micro Actuators/Microfluidics	P30 - P39	25
Magnetostrictive Actuators	P40 - P44	26
ERF/MRF Actuators	P45 - P49, P82	27
Shape Memory Actuators	P51 - P53	28
Low-Power Electromagnetic Actuators	P54 - P62	29
Polymer Actuators	P63 - P65	30
Other Actuators	P66 - P68	30
Aeronautical/Aerospace Applications	P70 - P73	31
Medical Applications	P75	31
Nanopositioning/Nanomanipulation	P76 - P79	32
Vibration Control	P80	32
List of Exhibitors		692
List of Authors		707

Oral Contributions

A1 Piezoelectric Actuators I

Technical Papers and Authors	No.	Page
Piezoelectric Actuators 2002 - New Material, Design and Drive/Control Related Issues <i>K. Uchino,</i> <i>The Pennsylvania State University, University Park, USA</i>	A1.0	33
Modelling, Characterisation and Implementation of a Monolithic Piezo-Actuator (MPA) of 2 and 3 Degrees of Freedom (DOF) <i>R. Pérez, A. Lal, Y. Miyahara, J.-M. Breguet, H. Bleuler</i> <i>Ecole Polytechnique Fédérale de Lausanne, Switzerland</i>	A1.1	41
The Shear Effect in Piezo-Ferroelectric Ceramics and it's Application to Actuator Devices <i>P. Pertsch, D. Rößger, E. Hennig, W. Plötner, A. Bauer</i> <i>PI Ceramic GmbH, Lederhose, Germany</i>	A1.2	45
Radial Field Piezoelectric Diaphragms <i>R. G. Bryant, NASA Langley Research Center, Hampton, USA</i> <i>R. T. Effinger IV, Texas A & M University, College Station, USA</i> <i>B. M. Copeland Jr., NASA Langley Research Center, Hampton, USA</i>	A1.3	49
Surface Acoustic Wave Motor Using Silicon Slider and Energy Circulation Stator <i>M. K. Kurosawa, T. Nakashita, H. Nanzawa, T. Shigematsu</i> <i>Tokyo Institute of Technology, Yokohama, Japan</i> <i>K. Asai, Matsushita Electric Industrial Co., Ltd., Kyoto, Japan</i>	A1.4	55
Self-Supplied Piezoelectric Sensor-Actuator <i>G. Bertolotto Bianc, A. Manara, P. Mandurino, ABB Service Srl,</i> <i>Sesto S. Giovanni, Italy</i> <i>C. Ascari, F. Colombo, ABB SACE Spa, Vittuone, Italy</i>	A1.5	59
Several Types of Piezoelectric Transformer for Small Coil-Less High-Efficiency Power Supplies <i>T. Endow, S. Hirose, Yamagata University, Yonezawa, Japan</i> <i>T. Takano, Tohoko Institute of Technology, Sendai, Japan</i>	A1.6	63

Oral Contributions

A2 Shape Memory Actuators

Technical Papers and Authors	No.	Page
Specialty Shape Memory Alloy Films <i>M. Wuttig</i> <i>University of Maryland, University Park, USA</i>	A2.0	67
A Retrospective Evaluation of SMA Micro-Actuation <i>J. Peirs, D. Reynaerts, H. Van Brussel</i> <i>Katholieke Universiteit Leuven, Belgium</i>	A2.1	77
A Compact Actuator Based on Shape Memory Alloy Wires <i>M. Schleich, F. Pfeiffer</i> <i>Technische Universität München, Germany</i>	A2.2	81
Design Principles and New Actuator Applications with NiTi Straight Wire Actuators <i>M. Mertmann, Memory-Metalle GmbH, Weil, Germany</i> <i>S. Kautz, Siemens AG, Erlangen, Germany</i> <i>W. Brown, Dynalloy, Inc., Costa Mesa, USA</i>	A2.3	85
Bistable Shape Memory Composites for Switches, Grippers and Adjustable Capacitors <i>T. Sterzl, B. Winzek, H. Rumpf, E. Quandt</i> <i>CAESAR, Bonn, Germany</i>	A2.4	91
Shape Memory Composites with Phase-Coupled Motion <i>B. Winzek, H. Rumpf, T. Sterzl, E. Quandt</i> <i>CAESAR, Bonn, Germany</i>	A2.5	95

Oral Contributions

A3 Nanopositioning/Nanomanipulation

Technical Papers and Authors	No.	Page
Trends in Nanopositioning <i>K. Spanner, Physik Instrumente (PI) GmbH & Co, Karlsruhe, Germany</i>	A3.0 Part A	99
Trends in Nanomanipulation: From Nanomotor to Micro Production Line <i>V. Klocke Klocke Nanotechnik GmbH, Aachen, Germany</i>	A3.0 Part B	100
Conditions for Automated High-Precision Alignment Processes of Optronic Components <i>G. Kolbe, R. Glöß Physik Instrumente (PI) GmbH & Co., Karlsruhe, Germany</i>	A3.1	106
A Magnetic Manipulator for Single Cell Manipulation: Behavior and Control <i>M. Gauthier, E. Piat Laboratoire d'Automatique de Besancon, France</i>	A3.2	110
Micro- and Nanomanipulation Inside the SEM <i>H.-G. Braun, E. Meyer, Institut für Polymerforschung Dresden e. V., Germany</i>	A3.3	116
Extraction and Manipulation of Biological Specimen Combining UV-Laser-Ablation and Atomic-Force Microscopy <i>R. W. Stark, Ludwig-Maximilians-Universität München, Germany/ETH Zürich, Switzerland J. Rubio, S. Thalhammer, W. M. Heckl, Ludwig-Maximilians-Universität München, Germany</i>	A3.4	117

Oral Contributions

A4 Piezoelectric Actuators II: Applications

Technical Papers and Authors	No.	Page
Piezoelectric Actuators: Expanding Applications and Reliability Issues <i>K. Lubitz</i> <i>Siemens AG, München, Germany</i>	A4.0	121
Low Cost Precision Control of Piezo-Ceramic Actuators <i>P. M. Weaver, S. C. Powell</i> <i>PBT Ltd., Harlow, Great Britain</i>	A4.1	122
A Piezoelectric Shear-Shear Mode Ultrasonic Motor <i>S. Dong, Virginia Polytechnic Institute and State University, Blacksburg, USA</i> <i>H. W. Kim, The Pennsylvania State University, University Park, USA</i> <i>M. T. Strauss, HME, Newburyport, USA</i> <i>K. Uchino, The Pennsylvania State University, University Park, USA</i> <i>D. Viehland, Virginia Polytechnic Institute and State University, Blacksburg, USA</i>	A4.2	126
Fast Responding Automotive Microinjector, Operating with a Multiplicated Piezoelectric Actuator <i>C. Anzinger, U. Schmid, G. Krötz</i> <i>EADS Deutschland GmbH, München, Germany</i>	A4.3	130
Actuators in Astronomical Instrumentation <i>R.-R. Rohloff</i> <i>Max-Planck-Institut für Astronomie, Heidelberg, Germany</i>	A4.4	134
Real-Time Temperature Measurement Inside a Printhead Actuator <i>A. Jorzick, W. Zapka</i> <i>Xaar Jet AB, Järfälla, Sweden</i>	A4.5	138
Valves Based on Amplified Piezoelectric Actuators <i>R. Le Letty, N. Lhermet, G. Patient, F. Claeysen</i> <i>Cedrat Technologies, Meylan, France</i> <i>M. Lang, European Space Agency, Noordwijk, The Netherlands</i>	A4.6	141
Self-Tuning of the Dynamic Behavior of Piezoelectric-Driven Systems <i>R. Glöß</i> <i>Physik Instrumente (PI) GmbH & Co., Karlsruhe, Germany</i>	A4.7	145

Oral Contributions

A5 Magnetostrictive Actuators

Technical Papers and Authors	No.	Page
Actuators Based on Giant Magnetostrictive Materials <i>F. Claeysen, N. Lhermet</i> <i>Cedrat Technologies, Meylan, France</i>	A5.0	148
High Power Actuator Driven by a Magnetic Field of Fe-Pd Alloy Film <i>H. Yabe, Y. Komori, Y. Nishi</i> <i>Tokai University, Kanagawa, Japan</i>	A5.1	154
Applications of Magnetic Shape Memory Actuators <i>I. Suorsa, J. Tellinen, E. Pagounis, I. Aaltio, K. Ullakko</i> <i>Adaptamat Ltd., Helsinki, Finland</i>	A5.2	158
Formation of Giant Magnetostrictive Thin Films by Ion Plating Proces <i>Y. Matsumura, H. Uchida, A. Tonegawa, T. O. Yamaki, T. Shimizu, K. Ishida, M. Takeuchi, M. Ono</i> <i>Tokai University, Hiratsuka, Japan</i>	A5.3	162
Thin Film Magnetostrictive Actuation of a 2D Scanning Silicon Micro-Mirror <i>T. Bourouina, The University of Tokyo, Japan/IEF, Orsay, Paris, France</i> <i>G. Reyne, The University of Tokyo, Japan/LEG, INPG, Grenoble, France</i> <i>E. Lebrasseur, The University of Tokyo, Japan/MEMSCAP, Grenoble, France</i> <i>H. Fujita, The University of Tokyo, Japan</i> <i>A. Ludwig, E. Quandt, CAESAR, Bonn, Germany</i> <i>H. Muro, T. Oki, A. Asaoka, Nissan Motor Company, Japan</i>	A5.4	166

Oral Contributions

A6 Low-Power Electromagnetic Actuators

Technical Papers and Authors	No.	Page
Electromagnetic Actuators – Current Developments and Examples <i>K. Hameyer, Katholieke Universiteit Leuven, Belgium</i> <i>M. Nienhaus, Mymotors & Actuators GmbH, Wendelsheim, Germany</i>	A6.0	170
Design, Fabrication and Characterization of a Miniature Linear Asynchronous Motor <i>M. Föhse, J. Edler, H.-D. Stölting, H. H. Gatzen</i> <i>Universität Hannover, Germany</i>	A6.1	176
Flexible Electrostatic Linear Actuator <i>T. Nishijima, Gifu Prefectural Research Institute of Manufacturing Information Technology, Japan</i> <i>A. Yamamoto, S. Oyama, T. Higuchi, The University of Tokyo, Japan</i> <i>A. Inaba, Gifu Prefectural Research Institute of Manufacturing Information Technology, Japan</i>	A6.2	180
Short Stroke Actuators with Halbach-Like Magnet Arrays <i>H. J. Goossens</i> <i>Philips Research Laboratories, Eindhoven, The Netherlands</i>	A6.3	184
New Developments in the Linear Voice Coil Actuator Technology <i>M. Godkin</i> <i>BEI Kimco Magnetics Division, San Marcos, USA</i>	A6.4	188
A New Planar Electromagnetic Micromotor with Ultrasmall Volume <i>J.-B. Schweer</i> <i>Maxon Motor AG, Sachseln, Switzerland</i>	A6.5	192
Low Cost - High Speed Small Size Disk Magnet Synchronous Motor <i>S. Biwersi, L. Billet, P. Gandel, D. Prudham</i> <i>Moving Magnet Technologies SA, Besancon, France</i>	A6.6	196
An Innovative Type of Window Regulator Motor for Doors of Passenger Cars <i>T. Börnchen, H. Sesselmann, M. Schultz</i> <i>Brose Fahrzeugteile GmbH & Co. KG, Hallstadt, Germany</i>	A6.7	201

Oral Contributions

A6 Low-Power Electromagnetic Actuators

Technical Papers and Authors	No.	Page
Hollow Shaft Micro Servo Actuators Realized with the Micro Harmonic Drive® <i>R. Degen, R. Slatter</i> <i>Micromotion GmbH, Mainz, Germany</i>	A6.8	205
Integration of Miniaturized Fast Acting Valves in Pneumatic Drives <i>V. Zöppig, Steinbeis Transferzentrum Mechatronik, Ilmenau, Germany</i> <i>K. Feindt, T. Ströhla, H. Kube, E. Kallenbach</i> <i>Technische Universität Ilmenau, Germany</i>	A6.9	213

Oral Contributions

B1 Microfluidics

Technical Papers and Authors	No.	Page
State of the Art in Pneumatic Microvalves <i>M. Weinmann, A. Muth, M. Giousouf, C. Hanisch, P. Post</i> <i>FESTO AG & Co., Esslingen, Germany</i>	B1.0	217
A Novel Device for Flow Monitoring in Drug Delivery Systems <i>M. Richter, R. Keoschkerjan, M. Wackerle, U. Schaber, Y. Congar, A. Sayan</i> <i>Fraunhofer-IZM, München, Germany</i> <i>N. Lutter, Universität Erlangen-Nürnberg, Germany</i>	B1.1	223
A Novel Device for High Frequency Ejection of Nanoliter Jets <i>M. Wackerle, A. Drost, M. Richter</i> <i>Fraunhofer-IZM, München, Germany</i>	B1.2	227
A Modular Integrated Microfluidic Controller <i>Y. Liu, S. Dürr, D. Dittmann, M. Kohl</i> <i>Forschungszentrum Karlsruhe GmbH, Germany</i>	B1.3	231
Massive Parallel Liquid Dispensing in the Nanoliter Range by Pneumatic Actuation <i>P. Koltay, B. Birkenmeier, Universität Freiburg, Germany</i> <i>R. Steger, H. Sandmaier, HSG-IMIT, Villingen-Schwenningen, Germany</i> <i>R. Zengerle, Universität Freiburg, Germany</i>	B1.4	235
Development of Resonantly-Driven Piezoelectric Micropump and its Application to Micro Press <i>J.-H. Park, K. Yoshida, Y. Nakasu, S. Yokota</i> <i>Tokyo Institute of Technology, Japan</i> <i>T. Seto, K. Takagi, Seiko Epson Corporation, Suwa, Japan</i>	B1.5	240
Micro Components for Highly Parallelized Chemical and Biological Processes with Magnetic Beads <i>A. Albrecht, B. Halbedel, H. Wurmus,</i> <i>Technische Universität Ilmenau, Germany</i> <i>T. Frank, Little Things Factory GmbH, Ilmenau, Germany</i> <i>T. Henkel, G. Mayer, A. Schober,</i> <i>Institut für Physikalische Hochtechnologien, Jena, Germany</i> <i>U. Kunze, Cetoni GmbH, Gera-Korbußen, Germany</i>	B1.6	244

Oral Contributions

B2 Vibration Control

Technical Papers and Authors	No.	Page
Recent Advances in Active Damping and Vibration Control <i>H.-J. Karkosch, ContiTech Vibration Control GmbH, Hannover, Germany</i> <i>A. Preumont, Université Libre de Bruxelles, Belgium</i>	B2.0	248
Stiff and Soft Stewart Platforms for Active Damping and Active Isolation of Vibrations <i>A. Abu-Hanieh, M. Horodinca, A. Preumont</i> <i>Université Libre de Bruxelles, Belgium</i> <i>N. Loix, J. P. Verschueren, Micromega Dynamics S.A., Angleur, Belgium</i>	B2.1	254
Active Cancellation of Structure Borne Engine Vibrations in Passenger Cars with Thin Piezoceramic Plate Actuators <i>G. Huber, M. Lorenz, C. Bohn, V. Härtel</i> <i>Continental AG, Hannover, Germany</i>	B2.2	258
Vibrations Control Using Hybrid Dynamic Vibration Absorber (HDVAs) Based on Magnetostrictive Active Material <i>F. Franco, E. Monaco, L. Lecce</i> <i>University of Naples "Federico II", Italy</i>	B2.3	262
Modified Velocity-Feedback Controller with Collocated Piezoelectric Actuators/Sensors for Active Vibration Suppression <i>A. Schwinn, H. Janocha</i> <i>Universität des Saarlandes, Saarbrücken, Germany</i>	B2.4	266
Reliability Testing of NASA Piezocomposite Actuators <i>W. Wilkie, J. High, J. F. Bockman</i> <i>U.S. Army Research Laboratory and NASA Langley Research Center, Hampton, USA</i>	B2.5	270

Oral Contributions

B3 Aeronautical/Aerospace Applications

Technical Papers and Authors	No.	Page
Actuators for Aerospace Applications - Development and Trends <i>C. Anhalt, P. Wierach, E. Breitbach</i> <i>DLR, Braunschweig, Germany</i>	B3.0	274
MABE: High-Precision Tip/Tilt Mechanism Based on Magnetic Bearing Technology <i>N. Loix, J. P. Verschueren, Micromega Dynamics S.A., Angleur, Belgium</i> <i>L. Scolamiero, ESA/ESTEC TOS-MMM, Noordwijk, The Netherlands</i>	B3.1	280
Piezo Qualification for Space Applications <i>P. Guay, CNES, Toulouse, France</i> <i>F. Claeysen, R. Le Letty, Cedrat Technologies, Meylan, France</i>	B3.2	284
An Adaptive Bump for Transonic Shock Wave Drag Reduction <i>S. Ameduri, University of Naples, Italy</i> <i>A. Gianvito, A. Concilio, CIRA Italian Aerospace Research Centre, Capua, Italy</i>	B3.3	288
Experimental Assessment and Further Development of Amplified Piezo Actuators for Active Flap Devices <i>J.-L. Petitniot, ONERA, Lille, France</i> <i>H. Mercier des Rochettes, ONERA, Lille, France</i> <i>P. Leconte, ONERA, Châtillon, France</i>	B3.4	296

Oral Contributions

B4 Micro Actuators

Technical Papers and Authors	No.	Page
Measuring Techniques for Microactuators <i>H. Löwe, K. Hecker</i> <i>Institut für Mikrotechnik Mainz GmbH, Germany</i>	B4.0	300
Bulk Silicon Micromachined Electrostatic Microactuators For Use in Optical MEMS <i>M. Hoffmann, D. Nüsse, E. Voges</i> <i>Universität Dortmund, Germany</i>	B4.1	304
Self-Sustaining Micro Mechanical Power Source <i>S. Bogdanov, S. Pobering, N. Schwesinger</i> <i>Technische Universität München, Germany</i>	B4.2	308
A Miniaturized Laser Scanner in LIGA Technology (Mils) <i>B. Krevet, S. Hoffmann, M. Kohl, T. Kunz, J. Mohr,</i> <i>Forschungszentrum Karlsruhe GmbH, Germany</i> <i>G. Oliva, Datalogic S.p.A., Bologna, Italy</i>	B4.3	312
A Field Mill Based on the Modular Mems Framework Match-X <i>P. Matuscheck, J. Evers, W. Schäfer, Fraunhofer-IPA, Stuttgart, Germany</i> <i>M. Nienhaus, S. Kleen, mymotors & actuators GmbH,</i> <i>Wendelsheim, Germany</i>	B4.4	316
A Novel Microgripper with Parallel Movement of Gripping Arms <i>R. Keoschkerjan, Fraunhofer-IZM, München, Germany</i> <i>H. Wurmus, Technische Universität Ilmenau, Germany</i>	B4.5	321
Image Capturing Method Using a Microactuator with Diffraction Grating <i>M. Flaspöhler, M. Kuhn, C. Kaufmann, F. Guessous,</i> <i>J. Frühauf, T. Geßner, A. Hübler</i> <i>Technische Universität Chemnitz, Germany</i>	B4.6	325
Realization of Electrostatically Driven Actuators Using Curved Electrodes Fabricated by Using Silicon Bulk Micromachining Techniques <i>M. Hanf, F. Bennini, J. Frühauf, E. Gärtner, W. Dötzel</i> <i>Technische Universität Chemnitz, Germany</i>	B4.7	329

Oral Contributions

B5 ERF/MRF Actuators

Technical Papers and Authors	No.	Page
Controllable Fluids in 2002 - Status of ER and MR Fluid Technology <i>J. L. Sproston, The University of Liverpool, Great Britain</i> <i>L. C. Yanyo, J. D. Carlson, Lord Corporation, Cary, USA</i> <i>A. K. El Wahed, University of Dundee, Great Britain</i>	B5.0	333
Controllable Magnetorheological Dampers for Shock and Vibration <i>U. Lange, Hochschule für Technik und Wirtschaft Dresden, Germany</i> <i>S. Vassileva, Bulgarian Academy of Sciences, Sofia, Bulgaria</i> <i>L. Zipser, Hochschule für Technik und Wirtschaft Dresden, Germany</i>	B5.1	339
Active Hydrostatic Bearing with Magnetorheological Fluid <i>J. Hesselbach, C. Abel-Keilhack</i> <i>Technische Universität Braunschweig, Germany</i>	B5.2	343
Modelling the Magnetic Properties and Dynamic Behaviour of MRF-Valves in Flow Mode <i>A. Steck</i> <i>Fraunhofer-IPA, Stuttgart, Germany</i>	B5.3	347
ER Fluid Based Haptic System for Virtual Reality <i>H. Böse, Fraunhofer-ISC, Würzburg, Germany</i> <i>G. J. Monkman, Fachhochschule Regensburg, Germany</i> <i>H. Freimuth, D. Klein, Institut für Mikrotechnik Mainz GmbH, Germany</i> <i>H. Ermert, Ruhr-Universität Bochum, Germany</i> <i>M. Baumann, Fraunhofer-ISC, Würzburg, Germany</i> <i>S. Egersdörfer, Fachhochschule Regensburg, Germany</i> <i>O. T. Bruhns, Ruhr-Universität Bochum, Germany</i>	B5.4	351

Oral Contributions

B6 Medical Applications

Technical Papers and Authors	No.	Page
Recent Developments in SMA Thin Film Based Micro-Actuators for Biomedical and Fiber Optics Applications <i>V. Gupta, V. Martynov, A. D. Johnson</i> <i>TiNi Alloy Company, San Leandro, USA</i>	B6.1	355
A Piezoelectric Actuator for MR Elastography <i>C. Abicht, Technische Universität München, Garching, Germany</i> <i>K. Uffmann, Universitätsklinikum Essen, Germany</i> <i>H. Ulbrich, Technische Universität München, Garching, Germany</i> <i>J. Debatin, M. Ladd, Universitätsklinikum Essen, Germany</i>	B6.2	359
Feeding and Control Electronic of a Piezoelectric Actuator <i>M. Budinger, Laboratoire d'Electrotechnique et d'Electronique Industrielle, Toulouse, France</i> <i>F. Giraud, Laboratoire d'Electrotechnique et d'Electronique de Puissance, Villeneuve d'Ascq, France</i> <i>B. Nogarède, J.-F. Rouchon, Laboratoire d'Electrotechnique et d'Electronique Industrielle, Toulouse, France</i> <i>B. Lemaire-Semail, Laboratoire d'Electrotechnique et d'Electronique de Puissance, Villeneuve d'Ascq, France</i>	B6.3	363
Upper Limb Multifunctional Prosthetics, the Manus Concept <i>J. L. Pons, R. Ceres, Consejo Superior de Investigaciones Científicas, Arganda del Rey, Spain</i> <i>D. Reynaerts, Katholieke Universiteit Leuven, Belgium</i> <i>B. Saro, Centro de Recuperación de Minusvalidos Físicos, IMSERSO, Spain</i> <i>S. Levin, Alorman Advanced Medical Technologies Ltd., Israel</i> <i>D. Van Moorleghe, Advanced Material Technologies N.V., Belgium</i>	B6.4	367

Oral Contributions

B7 Polymer Actuators

Technical Papers and Authors	No.	Page
Polymer Actuators <i>P. Sommer-Larsen, Risø National Laboratory, Roskilde, Denmark</i> <i>R. Kornbluh, SRI International, Menlo Park, USA</i>	B7.0	371
Ionic Polymer-Conductor Composites (IPCC's) as Biomimetic Robotic Actuators, Sensors and Artificial Muscles – A Brief Review <i>M. Shahinpoor</i> <i>The University of New Mexico, Albuquerque, USA</i>	B7.1	379
Dielectric Elastomer Actuators with Smart Metallic Compliant Electrodes <i>M. Benslimane, P. Gravesen, Danfoss A/S, Nordborg, Denmark</i> <i>P. Sommer-Larsen, Risø National Laboratory, Roskilde, Denmark</i>	B7.2	383
Microactuators Based on Polypyrrole for Biomedicine <i>E. W. H. Jager, A. Selbing, M. Krogh, M. Skoglund,</i> <i>Micromuscle AB, Linköping, Sweden</i> <i>O. Inganäs, C. Immerstrand, K. Holmgren-Peterson, K.-E. Magnusson,</i> <i>Linköping University, Sweden</i>	B7.3	388
Electrostatic Actuators with Elastic Dielectric for Use on Tactile Displays <i>M. Jungmann, H. F. Schlaak</i> <i>Technische Universität Darmstadt, Germany</i>	B7.4	391

Poster Contributions

Piezoelectric Actuators

Technical Papers and Authors	No.	Page
The Research of Piezoelectric Control Method Using Mathematical Modeling <i>L. N. Sun, J. Xu, W. B. Rong</i> <i>Harbin Institute of Technology, P. R. of China</i>	P1	395
A Novel Piezoelectric Ultrasonic Linear Micro Actuator <i>D. C. Li, Z. M. Zeng, B. L. Zhao, Z. B. Zhang, S. J. Jin</i> <i>Tianjin University, P. R. of China</i>	P2	399
Properties of PZT Multilayer Actuators <i>A. Heinzmann, E. Hennig, B. Kolle, D. Kopsch, S. Richter,</i> <i>H. Schwotzer, E. Wehrsdorfer</i> <i>PI Ceramic GmbH, Lederhose, Germany</i>	P3	403
Two-Phase Piezoelectric Linear Actuators Based on the Longitudinal and Bending Acoustic Waves for Ultrasonic Motors <i>W. Wischnewskiy, S. Kovalev</i> <i>Physik Instrumente (PI) GmbH & Co., Karlsruhe, Germany</i>	P5	407
Application Specific Components: Ceramic Multi-Layer Bending Rings <i>S. Ouchouche, C. Goueffon, B. Andersen</i> <i>Noliac A/S, Kvistgaard, Denmark</i>	P6	413
Experimental and Numerical Analysis on Bimorph Piezo-Actuators <i>G. Belforte, M. Sorli, L. Gastaldi</i> <i>Politecnico di Torino, Italy</i>	P7	417
On A Mathematical Model of a Wobbling-Disc Ultrasonic Motor <i>S. Gutschmidt, P. Hagedorn</i> <i>Technische Universität Darmstadt, Germany</i>	P8	421
On the Analysis of a Piezoelectric Bimorphs Actuator for In-Pipe Micro Locomotive Mechanism <i>P. K. Liu, L. N. Sun, D. S. Qu, M. T. Li, Y. F. Zhao</i> <i>Harbin Institute of Technology, P. R. of China</i>	P9	425
Fast Feedback Control of Piezoelectric Actuators <i>G. Schitter, R. W. Stark, A. Stemmer</i> <i>ETH Zürich, Switzerland</i>	P10	430

Technical Papers and Authors	No.	Page
Characterisation and Modelling of Piezoelectric Bending Actuators <i>T. Rödig, Technische Universität Dresden, Germany</i> <i>A. Schönecker, Fraunhofer-IKTS, Dresden, Germany</i> <i>R. Gerstenberger, Technische Universität Dresden, Germany</i>	P11	434
Behaviour of Piezoelectric Micropush Motors with Varying Loads <i>G. Diefenbach, Philips GmbH Forschungslaboratorien, Aachen, Germany</i> <i>C. Reichinger, Siemens VDO Automotive, Regensburg, Germany</i>	P12	438
PWM-Converter for Travelling Wave Type Ultrasonic Motors <i>T. Schulte, N. Fröhleke</i> <i>Universität Paderborn, Germany</i>	P13	442
Piezoelectric Linear Actuator Using L1-F2 Double-Resonance-Mode Trident Type Tuning-Fork Resonator <i>Y. Tomikawa, K. Ueda, Yamagata University, Yonezawa, Japan</i> <i>T. Takano, Tohoku Institute of Technology, Sendai, Japan</i>	P14	446
Characteristics of Gyro-Moment Motor <i>Y. Tomikawa, Y. Matsuzawa</i> <i>Yamagata University, Yonezawa, Japan</i>	P15	450
New High Speed Current Controlled Amplifier for PZT Multilayer Stack Actuators <i>C. Dörlemann, P. Muß, M. Schugt, R. Uhlenbrock</i> <i>ScienLab Electronic Systems GmbH, Bochum, Germany</i>	P16	454
New Structure of Ultrasonic Motor Using Longitudinal and Bending Vibration Modes of a Rectangular Plate <i>T. Takano, Tohoku Institute of Technology, Sendai, Japan</i> <i>Y. Tomikawa, M. Aoyagi, S. Hirose</i> <i>Yamagata University, Yonezawa, Japan</i>	P17	458
New Power Amplifier Concept for Piezoelectric Actuators <i>H. Janocha, R. Quinten</i> <i>Universität des Saarlandes, Saarbrücken, Germany</i>	P18	462
Modelling and Experiments of a Standing Wave Piezomotor <i>B. Andersen, J. Helbo, Aalborg University, Denmark</i> <i>M. Blanke, Technical University of Denmark, Lyngby, Denmark</i>	P19	466
A Piezo-Electrical Travelling Wave XY-Stage <i>S. Devos, D. Reynaerts, F. Al-Bender, H. Van Brussel</i> <i>Katholieke Universiteit Leuven, Belgium</i>	P20	470

Technical Papers and Authors	No.	Page
Analytical Stator Study of Cylindrical Ultrasonic Motors <i>M. Budinger, J.-F. Rouchon, B. Nogarède</i> <i>LEEI, Toulouse, France</i>	P21	474
Design of a Travelling-Wave Ultrasonic Piezoelectric Micromotor in Silicon Using DRIE <i>S. A. Wilson, P. J. Rayner, R. W. Whatmore</i> <i>Cranfield University, Great Britain</i>	P22	478
Miniaturizing High Voltage Amplifiers for Piezoelectric Actuators <i>P. Robinson, J. F. Bockman, T. Blackburn</i> <i>NASA Langley Research Center, Hampton, USA</i>	P23	482
Resonant Power Converter for Ultrasonic Piezoelectric Converter <i>C. Kauczor, T. Schulte, N. Fröhleke</i> <i>Universität Paderborn, Germany</i>	P24	485
Experimental Analysis of a New Type of Flexensional Ultrasonic Piezoelectric Motor <i>J. T. Leinvuo, S. A. Wilson, R. W. Whatmore</i> <i>Cranfield University, Great Britain</i>	P25	489
Actuator of Type "A Shaking Beam" <i>P. Vasiljev</i> <i>Vilnius Pedagogical University, Lithuania</i>	P26	493
Dresser With Piezoelectric Actuator <i>M. G. Furxhi</i> <i>Meccanodora S.p.A., Bosconero, Italy</i>	P27	497
Converter Design and Control of Piezoelectric Multiactuator Systems in Sliding Mode Operation <i>F. Palis, D. Heller, S. Sokolov</i> <i>Otto-von-Guericke-Universität Magdeburg, Germany</i>	P28	502
Application of Piezoceramic Ultrasonic Linear Motors in XY-Linear Precision Stages <i>A. Bromme, R. Scheurle</i> <i>Steinmeyer Feinmess Dresden GmbH, Germany</i>	P29	506
Low Voltage Piezoelectric Actuator with Integrated Strain Gauge – A New Technology for Industrial Automation <i>A. J. Schmid, T. Wich, T. Fischer, U. Töpfer</i> <i>Siemens AG, Redwitz, Germany</i> <i>T. Steinkopff, C. Schuh, Siemens AG, München, Germany</i> <i>M. Weinmann, M. Maichl, G. Munz, C. Hanisch</i> <i>FESTO AG & Co., Esslingen, Germany</i> <i>H. F. Schlaak, R. Ballas, Technische Universität Darmstadt, Germany</i> <i>M. Hoffmann, S. Wagner, Universität Karlsruhe, Germany</i>	P83	512

Poster Contributions

Micro Actuators/Microfluidics

Technical Papers and Authors	No.	Page
Modal Analysis for the Head Actuator of a Hard Disk Driver <i>G. Z. Yao, C. K. Mechefske, Queen's University, Kingston, Canada</i> <i>R. M. Lin, D. J. Ewins, Nanyang Technological University, Singapore</i> <i>M. Klein, Universität des Saarlandes, Saarbrücken, Germany</i>	P30	516
Simulation and Optimization of RF MEMS Switch <i>H. Zhang, J. Zhang, M. Miao, Y. Jin</i> <i>Peking University, P. R. of China</i>	P31	520
Impact of Miniaturisation Technologies on the Structure and Performances of Micro Motor for Watches Applications <i>P. Meneroud, M. Azeau, F. Bloch, F. Claeysen</i> <i>Cedrat Technologies, Meylan, France</i>	P33	524
Problems and Issues in the Development of Inexpensive High-Aspect-Ratio MEMS Mechanical Logic Devices for Fuze Safety and Arming <i>C. Robinson, R. Wood, T. Hoang</i> <i>U.S. Army TACOM ARDEC Fuze Division, Adelphi, USA</i>	P34	528
A 3/2 Normally Closed Polymer Piezoelectric Microvalve with Integrated MID Electronics for Industrial Automation <i>M. Weinmann, M. Maichl, G. Munz, C. Hanisch, P. Post,</i> <i>FESTO AG & Co., Esslingen, Germany</i> <i>H. Kück, W. Eberhardt, C. Pein, HSG-IMAT, Stuttgart, Germany</i> <i>F. Pöhlau, Oechsler AG, Ansbach, Germany</i>	P36	533
Two-Dimensional Array of Piezostack Actuated Nanoliter Dispensers <i>R. Steger, HSG-IMIT, Villingen-Schwenningen, Germany</i> <i>P. Koltay, G. Birkle, Universität Freiburg, Germany</i> <i>T. Strobelt, H. Sandmaier, HSG-IMIT, Villingen-Schwenningen, Germany</i> <i>R. Zengerle, Universität Freiburg, Germany</i>	P37	537
Generation of Nanoliter Droplets with a Piezoelectric Drop-On-Demand Pump <i>T. Müller, K.-H. Hirschmann</i> <i>Universität Rostock, Germany</i>	P38	542
A Modular Fluidic Demonstrator for the Match-X Framework <i>F. Schindler-Saefkow, K. Amiri Jam, F. Luczak, Fraunhofer-IZM, Berlin, Germany</i> <i>V. Großer, B. Michel, Fraunhofer-IZM, Berlin, Germany</i> <i>G. Günther, RWTH Aachen, Germany</i>	P39	546

Poster Contributions

Magnetostrictive Actuators

Technical Papers and Authors	No.	Page
Observations of Dynamic Magnetic Structures from Terfenol-D Surfaces <i>N. J. Mellors, D. G. Lord, X. G. Zhao</i> <i>University of Salford, Great Britain</i>	P40	551
Design Procedures for Optimal Use of Giant Magnetostrictive Materials in Magnetostrictive Actuator Applications <i>G. Engdahl</i> <i>Royal Institute of Technology, Stockholm, Sweden</i>	P41	554
Modelling and Simulation of Magnetostrictive Actuators <i>M. G. Salloker</i> <i>FH Joanneum Gesellschaft mbH, Kapfenberg, Austria</i>	P42	558
Nonlinear Modelling and Parameter Identification of Magnetostrictive Actuators Based on Jiles-Atherton Models <i>M. G. Salloker</i> <i>FH Joanneum Gesellschaft mbH, Kapfenberg, Austria</i>	P43	562
Basic Properties of Magnetic Shape Memory Actuators <i>J. Tellinen, I. Suorsa, A. Jääskeläinen, I. Aaltio, K. Ullakko</i> <i>Adaptamat Ltd., Helsinki, Finland</i>	P44	566

Poster Contributions

ERF/MRF Actuators

Technical Papers and Authors	No.	Page
Measurement of Sedimentation Stability of Magnetorheological Fluids <i>J. Tervo, P. Andersson, S. Varjus</i> <i>VTT Industrial Systems, Espoo, Finland</i>	P45	570
The Rheology of Electrorheological Fluids in Dynamic Squeeze Flow <i>A. K. El Wahed, University of Dundee, Great Britain</i> <i>J. L. Sproston, University of Liverpool, Great Britain</i> <i>R. Stanway, University of Sheffield, Great Britain</i>	P46	573
Adaptive Rotary Damper Based on Magnetorheological Fluid for Automotive Applications <i>M. Biasiotto, F. Butera</i> <i>Centro Ricerche FIAT, Orbassano, Italy</i>	P49	577
Electronics and Mechanics - A Balance Act in ERF-Applications <i>L. Johnston, H. Rosenfeldt, Fludicon GmbH, Darmstadt, Germany</i> <i>M. Krämer, Schenk Fertigungs-GmbH, Darmstadt, Germany</i>	P82	581

Poster Contributions

Shape Memory Actuators

Technical Papers and Authors	No.	Page
Actuator Development Using a Knowledge Base <i>J. Breidert, E. G. Welp</i> <i>Ruhr-Universität Bochum, Germany</i>	P51	584
Optimal Design of Shape Memory Alloy Wire Bundle Actuators <i>K. J. De Laurentis, A. Fisch, J. Nikitczuk, C. Mavroidis</i> <i>Rutgers University, The State University of New Jersey, Piscataway, USA</i>	P52	588
Comparison of the Thermomechanical Behaviour of Two Kinds of Ti-Ni Helical Springs <i>P. Olier, P. Haltebourg, S. Drolon,</i> <i>Commissariat d'Energie Atomique, Saclay, France</i> <i>J. M. Alexandre, Commissariat d'Energie Atomique,</i> <i>Fontenay-aux-Roses, France</i>	P53	592

Poster Contributions

Low-Power Electromagnetic Actuators

Technical Papers and Authors	No.	Page
Design of High Power Density Electromagnetic Actuators for a Portable Braille Display <i>T. Nobels, Katholieke Universiteit Leuven, Belgium</i> <i>F. Allemeersch, Sensotec, N. V., Varsenare, Belgium</i> <i>K. Hameyer, Katholieke Universiteit Leuven, Belgium</i>	P54	596
Design and Optimization of Electromagnetic Actuators for Mechanical and Automotive Applications <i>C. Oberbeck, H. Ulbrich</i> <i>Technische Universität München, Garching, Germany</i>	P55	600
Dynamic Simulation of Electromagnetic Actuators Using Network Models Including Eddy Currents <i>E. Kallenbach, T. Ströhla</i> <i>Technische Universität Ilmenau, Germany</i>	P56	604
SESAM - A Software that Supports the Design Process of Electromagnetic Actuators <i>O. Birli, E. Kallenbach, K. Feindt, T. Ströhla</i> <i>Technische Universität Ilmenau, Germany</i>	P57	608
A New Type Single-Phase Permanent-Magnetic Stepper Motor <i>Y. Qing, Q. Xinfen, Q. Jianfei, L. Rongxian</i> <i>China Academy of Engineering Physics, Mianyang, P. R. of China</i>	P58	612
Compact Hollow Shaft Actuators For Precise Positioning Applications <i>R. Slatter</i> <i>Harmonic Drive AG, Limburg, Germany</i>	P59	616
AMESim, Electromagnetic and Micro Actuators Library <i>F. Brix, F. Seillier, M. Lebrun</i> <i>IMAGINE S.A., Roanne, France</i>	P61	622
Smart Actuator for Intelligent Electrical Parking Brake System – Functionality and Safety, System Approach <i>C. Baier-Welt</i> <i>Siemens VDO Automotive AG, Würzburg, Germany</i>	P62	628

Poster Contributions

Polymer Actuators

Technical Papers and Authors	No.	Page
The Possibility of Electro-Active Papers as Actuators <i>J. Kim, Inha University, Incheon, Korea</i> <i>J. Su, J. S. Harrison, S. H. Choi,</i> <i>NASA Langley Research Center, Hampton, USA</i>	P63	632
Rapid Optical Actuator Using the Phase Transition of a Polymer Crystal <i>T. Ikehara, S. Shimada, H. Matsuda,</i> <i>National Institute of Advanced Industrial Science and Technology,</i> <i>Tsukuba, Japan</i> <i>M. Tanaka, Nihon University, Funabashi, Japan</i>	P64	636
Performances of Dielectric Elastomer Planar Actuators <i>F. Carpi, P. Chiarelli, A. Mazzoldi, D. De Rossi</i> <i>University of Pisa and CNR Institute of Clinical Physiology, Pisa, Italy</i>	P65	640

Other Actuators

Coupling Between Active Polymer Gels and Fibre Structures for Tailored Functionality <i>G. Jeronimidis</i> <i>The University of Reading, Great Britain</i>	P66	644
High Power Actuator Driven by a Hydrogen Storage LaNi_x Film <i>H. Yabe, Y. Isogai, B. Kim, H.-H. Uchida, Y. Nishi</i> <i>Tokai University, Kanagawa, Japan</i>	P67	648
Development of High-Power Electrostatic Linear Motor for Vacuum Environment <i>H. Yasui, A. Yamamoto, T. Higuchi</i> <i>The University of Tokyo, Japan</i>	P68	652

Poster Contributions

Aeronautical/Aerospace Applications

Technical Papers and Authors	No.	Page
Design of an Adaptive Windtunnel Mockup with Shape Memory Actuators <i>G. Pritschow, W. Wadehn</i> <i>Universität Stuttgart, Germany</i>	P70	656
Robust Control Method for Aircraft's Electro-Hydraulic Servo-Drive <i>Z. Gosiewski, M. Henzel</i> <i>Military University of Technology, Warsaw, Poland</i>	P71	660
Miniaturised Bipolar Electromagnetic Actuators for Space Applications <i>T. Roschke</i> <i>Technische Universität Dresden, Germany</i>	P73	664

Medical Applications

Cutting with Flexible Ultrasound Transmission for Minimally Invasive Surgery with Biological Inspiration <i>F. Qiao, Technische Universität Ilmenau, Germany</i> <i>F. Roces, Universität Würzburg, Germany</i> <i>C. Schilling, H. Wurmus, Technische Universität Ilmenau, Germany</i>	P75	668
---	-----	-----

Poster Contributions

Nanopositioning/Nanomanipulation

Technical Papers and Authors	No.	Page
Nano-Linear Motor Based on Self-Moving Cell Concept <i>B. Kang, J. Kim, Inha University, Incheon, Korea</i> <i>K.-Y. Choi, H.-M. Kim, Nanonix Co., Taejeon, Korea</i>	P76	672
Novel Micromechanical Scanning Device with Large Vertical Positioning Range <i>U. Kotarsky, W. Manthey, M. Dietzsch, A. Bertz, Technische Universität Chemnitz, Germany</i> <i>T. Geßner, Technische Universität Chemnitz/Fraunhofer-IZM, Berlin/Chemnitz, Germany</i>	P77	676
An Open Loop Control for Piezoactuators in Micropositioning <i>J. Domingo, Polytechnical University of Catalonia, Barcelona, Spain</i> <i>M. Puig-Vidal, J. Samitier, University of Barcelona, Spain</i>	P78	680
Miniaturised Micro-Positioning System for Large Displacements and Large Forces Based on an Inchworm Platform <i>U. Jungnickel, D. Eicher, H. F. Schlaak Technische Universität Darmstadt, Germany</i>	P79	684

Vibration Control

Complex Hysteresis Modeling of a Broad Class of Hysteretic Actuator Nonlinearities <i>K. Kuhnen, H. Janocha</i> <i>Universität des Saarlandes, Saarbrücken, Germany</i>	P80	688
--	-----	-----