# INTERNATIONAL INSTITUTION FOR PRODUCTION ENGINEERING RESEARCH

## NEWSLETTER

edited by the Technical Secretary
**M. SANTOCHI**

Nr. 16 - April 2000

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## *From the Editor*

Dear Colleagues,
I wish to inform you the next issue of the CIRP Newsletter is scheduled for

**October 2000**

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All your contributions are welcome and will be considered for publication. For a fast and easy transmission of documents, you are invited to use the E-mail at the following address:

**santochi@ing.unipi.it**.

Please consider that the deadline for your contributions is:

**September 15th 2000**.

In addition I wish to remind you that a bibliographical research on CIRP Annals by authors, by title and by keywords is possible. Links to WEB pages of CIRP's members labs are available and links to your own page are welcome!
Since **August 2000** all the **abstracts** of the papers published in the Annals vol.49/1 will be available at the same WEB site. As already requested by mail, in order to achieve this goal, all the authors are kindly requested to send to the Technical secretary the final data of their paper (authors, title, keywords, abstract). The procedure is simple : just go to the following Internet address :

**http://www.ing.unipi.it/cirp**

and type the data.

The Technical Secretary
Prof. Marco Santochi

**Acknowledgement**

The Editor wishes to thank Mr. **E. Bellini**, Dept. of mechanical , nuclear and production engineering of the University of Pisa for his valuable help in preparing the Newsletter.

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Awards

# *Awards*

We are pleasured to announce that our colleague **Prof. M. C. Shaw** was presented the JSPE International Prize for achievements in Precision Engineering on October 27, 1999 at a ceremony in Tokyo, Japan. The meeting was attended by several CIRP members and many of the 20 co-workers who had spent extended periods in his laboratories at MIT Cambridge, Carnegie Tech in Pittsburgh, or Arizona State University in Tempe.

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It is our pleasure to announce that our colleague **James B. Bryan** was recently honored in Chicago as one of six "Heroes of U.S. Manufacturing," a recognition of his contributions to metrology and his innovations in improving the accuracy and in measuring the flaws in machine tools. In addition, in May, Bryan will receive a lifetime achievement award from the European Society for Precision Engineering.

It is our pleasure to announce that our colleague, **Prof. I. Inasaki** has been honoured by the Faculty of Mechanical Engineering of the University of Hannover, Germany, with the title "Doktor Ingenieur Ehren halber (Dr. -Ing. E.h.)"

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We are glad to announce that our colleague **Dr. Dirk F. Dauw**, Global Business Marketing Manager for Assembly Automation and Medical Assembly Systems at Ismeca Europe S.A., La Chaux-de-Fonds, Switzerland, was recently elected as Vice-President Region XIII of the American Society of Mechanical Engineers, ASME International.
During his three year term, Dr. Dauw will enhance the coordination, strategy and society development programs of all ASME International Regions outside the United States, Canada and Mexico. Region XIII is organized in four zones, Europe, Asia, Latin America & the Caribbean and Middle East and Africa.
Dauw was previously zone Chair Europe, Chair and Vice Chair of the Swiss Section of ASME International."

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It is our pleasure to announce that the Institute of Physics, London, in its October 99 meeting of the Board, named our colleague **Prof. H.E. Hintermann** a FIP, fellow of the institute of Physics, London, for his scientific and technical contributions in the past towards Surface Physics and Chemistry and towards the field of Nanosciences.
In 1997 our colleague was elected FIM, fellow of the Institute of Material Sciences, London, for his contributions in tribology and in the field of process development in Chmical and physical Vapour Deposition (CVD, PVD) of hard coatings and soft, dry lubricating thin films on cutting tools, bearings and general wear parts since the sixties, which developments had a decisive impact on the cutting tool industry.

From the Editor Go back to the Table of Contents Meetings, seminars and conferences

# *Meetings, seminars and conferences*

**ISEM XIII**

**13th International Symposium for Electromachining**

Euskalduna Congress Palace

Bilbao, Spain • May 9th-11th, 2001

**Topics**:

- Electric discharge machining (EDM);
- micro machining by non-traditional machining methods;
- laser beam machining (LBM);
- electrochemical machining (ECM);
- electron beam machining (EBM);
- ultrasonic machining (USM)
- water jet machining (WJM)
- other non-traditional machining methods (AJM, AFM, IBM, CHM…)
- rapid prototyping techniques (RP)
- environmental, safety and legal aspects of non-traditional machining

**For more information**:

Mr. FCO. Javier García Robles

ISEM XIII Secretariat Tekniker

Otaola, 20. 20600 Eibar

Spain

Phone: (34) 943 206744

Fax: (34) 943 202757

E-mail: jgarcia@tekniker.es

**Sächsische Fachtagung Umformtechnik SFU 2000**

**Light-weight construction by forming technology**

24-25 October 2000-03-13 Chemnitz, Germany

**Topics**:

- Light-weight construction by materials
  - hight-strength steels
  - non-ferrous alloys
  - composite materials
  - material composites

- Light-weight construction by structures
  - hydroforming
  - new half-wrought materials
  - cellular structures

- Light-weight construction by conditions
  - dimensioning
  - simulation
  - forming process
  - machine
  - component properties

**For more information**:

Fraunhofer-Institute for Machine Tools and Forming Technology IWU

Reichenhainer Straße 88

09126 Chemnitz

Germany

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Mrs. Daniela López

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Dr Rolf Nötzel

Phone: 03 71/53 97-4 38

fax: 03 71/53 97-4 48

e-mail: noetzel@iwu.fhg.de

**The 2nd Chemnitz Parallel Kinematics Seminar:**

**"Working Accuracy of Parallel Kinematics"**

**April 12/13, 2000**

**Chemnitz, Germany**

**Topics:**

- Fundamentals: design methods, design tools, modelling, simulation methods, comparison criteria, structures

- Control and measurement techniques: control algorithms, calibration methods, compensation, machine diagnosis, collision control

- Components: struts, joints, frame construction, drives, periphery

- Applications: type examples, application experiences, NC-programming, acceptance conditions

For more information:

Fraunhofer-Institute for Machine Tools and Forming Technology IWU

Reichenhainer Straße 88

09126 Chemnitz

Germany

http://www.iwu.fhg.de

Contact:

Daniela Lopez

Phone: +49(0)371/5397-328 Fax: +49(0)371/5397-448 e-mail: lopez@iwu.fhg.de

**IWMF 2000**

**Uni. NE - EPFL - CSEM**

**2nd International Workshop on Microfactories**

October 9-10, 2000

Fribourg, Switzerland

**Topics**:

1. System aspects of microfactories;
2. microassembly and handling: technology, actuators, sensors;
3. micromachining and 3-D microstructuring;
4. microfactories for medical, pharmaceutical and biotechnological applications;
5. microfactories for cleanrooms, space or other extreme environments;
6. link to nanotechnologies, innovations, visions for the future.

**Important dates**:

Submissions of the abstracts papers: **May 5, 2000**

**Format**: maximum 500 words, including title and authors with affiliation and addresses. The abstract must be submitted by e-mail to fischer@fsm.ch

Notification of acceptance: **May 31, 2000**

Submission of camera-ready paper: **July 31, 2000**

**For more information**:

IWMF 2000 c/o FSRM

Rue Jaquet-Droz, 1

CH 2007 Neuchâtel

Switzerland

Phone: +41 32 720 09 00

Fax: +41 32 720 09 90

e-mail: fsrm@fsrm. ch

http://www-samlab.unine.ch/iwmf2000/

**1st euspen Topical Conference on**

**Fabrication and Metrology in Nanotechnology**

**2nd general meeting of the european society for precision engineering and nanotechnology**

Copenhagen

May 28-30, 2000

**Topics**

- Micro and nanometrology
- Nano-fabrication processes and assembly
- Modelling and simulation in micro and nanotechnologies
- Analaysis of engineered surfaces using microscopy techniques
- Micro and nano-structure manufacturing
- Nanotechnology instrument development
- Other SPM applications: electrochemistry, surface modification, materials properties (spectroscopy). etc.

**For information**

Center for Geometrical Metrology

Department of Manufacturing Engineering

Technical University of Denmark

Building 425,

DK-2800 Lyngby, DENMARK

http://www.cgm.dk

Contact:

Prof. **Leonardo De Chiffre**

Tel.: +45 4525 4760

Fax: +45 4593 0190

e-mail: ldc@ipt.dtu.dk

**10th International Conference on Precision Engineering (ICPE)**

Pacifico Yokohama, Japan

July 18-20, 2001

Conference chairman : prof. I. Inasaki (Keio University, Japan)

**Topics**:

1. advanced manufacturing systems;
2. ultra-precision machining and micro machining;
3. nanotechnology for fabrication and measurements;
4. chemo-mechanical processes;
5. rapid prototyping technology;
6. new materials and advanced processes;

- computer-aided production engineering;
- manufacturing process control;
- planning and scheduling for production;
- CAD/CAM/CAE;
- Others (any topics related to precision engineering can be accepted for paper presentations)

**Important dates**:

deadline for extended abstracts: September 30, 2000

notification for acceptance (abstracts): November 30, 2000

deadline for camera-ready manuscripts: February 5, 2001

notification for acceptance (camera-ready): March 12, 2001

deadline for advanced registration: April 30, 2001

deadline for final camera-ready manuscripts: May 1, 2001

**For more information**:

Conference Secretariat 10th ICPE

The Japan Society for Precision Engineering (JSPE)

Kudan-Seiwa Building

1-5-9 Kudan-kita, Chiyoda-ku, Tokyo

102-0073 Japan

Phone: +81-3-5226-5191

Fax: +81-3-5226-5192

E-mail: icpe10@jspe.or.jp

http://www.jspe.or.jp/

**2nd International Conference**

**and 3rd general meeting of the**

**European Society for Precision Engineering and Nanotechnology**

May 28th- June 1st, 2001

"Torino Incontra" Congress Centre - Turin, Italy

**Topics**:

- mechanical ultra precision processes;
- non-mechanical ultra precision processes;
- ultra precision motion control,
- environmental/vibration control in micro and nano systems;
- ultra precision machines - micro & macro;
- precision engineering in aerospace technologies;
- metrology and nanometrology;
- optical and opto electronic developments;
- engineering at the nanoscale;
- material properties on the molecular and atomic scales;
- engineered and structured surfaces - fabrication and characterisation;
- nanofabrication and assembly;
- Micro Electro Mechanical Systems (MEMS);
- Micro Opto-Electro Mechanical Systems (MOEMS);

- silicon engineering;
- biotechnology and medical applications;
- optical engineering;
- modelling and simulation in micro and nanotechnologies.

**Important dates**:

October 15, 2000: deadline for abstracts

January 15, 2001: notification of acceptance

March 10, 2001: deadline for extended abstracts

February 28, 2001: deadline for registration (for the standard fees to apply)

May 28 - June 1, 2001: conference

**For more information**:

Conference Secretariat

e-mail: torino2001@euspen.org

URL: http://www.euspen.org/torino2001

Fax: +39 - 011-669 23 68

Euspen Headquarters

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E-mail: d.corker@cranfield.ac.uk

URL: http://www.euspen.org

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A symposium on

**Assembly systems: modelling, design and diagnosis**

**2000 International Mechanical Engineering Congress and Exposition (IMECE)**

November 5-10 Orlando, Florida

**Topics**:

- product data modelling for assembly;
- modular assembly systems and fixtures;
- reconfigurability and reusability analysis;
- tolerance analysis and synthesis;
- monitoring, diagnosis and process control of assembly processes;
- design for assembly and disassembly;
- non-rigid assemblies; large mechanical assemblies;
- dimensional management and variability control;
- assembly process validation.

**For more information**:

E-mail: darek@engin.umich.edu

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**7th CIRP International Seminar on Life Cycle Engineering**

**Life Cycle Planning, Design and Management for Eco-Products and Systems**

November 27, Mon. - 29, Wed., 2000

Sanjo-Kaikan (Conference Hall), The University of Tokyo

Tokyo, Japan

**Topics**:

the topics of this seminar is intended to cover the whole aspects of product life cycle, and includes, but are not limited to, the followings:

- life cycle planning, design and management;
- eco-product and system design;
- design for environment, recycling, reuse, disassembly, etc.;
- life cycle assessment and impact calculation;
- re-manufacturing and inverse processes;
- information infra-structure for sustainability.

**Important dates**:

March 31, 2000: abstract due

April 30, 2000: abstract acceptance notification

June 31, 2000: full paper due

July 31, 2000: full paper acceptance notification

September 15, 2000: camera-ready paper due

**For more information**:

Fumihiko Kimura

Department of Precision Machinery Engineering

The University of Tokyo

Hongo 7-3-1, Bunkyo-ku, Tokyo 113-8656, Japan

Tel.: +81-3-5841-6455

Fax: +81-3-5841-8556

E-mail: kimura@cim.pe.u-tokyo.ac.jp

*International Working Conference*

**Total Quality Management - Advanced and Intelligent Approaches**

June 25-29, 2001

Subotica - Palic klub ELLITE, Yugoslavia

Preliminary first announcement and call for papers

**Topics**:

- business excellence models (applications and development trends);
- TQM and manufacturing management;
- world class performance;
- attractive quality;
- robust engineering;

- six sigma model;
- intelligent quality tools and methods;
- virtual factory and virtual quality;
- business process improvement;
- breakthrough management;
- intelligent design for quality.

**Important dates**:

May 15, 2000 - Proposal for special sessions and tutorials

June 15, 2000 - Abstracts due 300 words minimum

August 15, 2000 - Notification of acceptance

October 15, 2000 - Full paper due; 6 pages maximum; electronic submission should be in PDF or Word format. Registration materials will be mailed in January 2001

January 15, 2001 - Registration announcement

February 15, 2001 - Final acceptance

March 15, 2001 - Camera-ready papers due

April 15, 2001 - Early registration due and Final program announcement

June 25-29, 2001 - International Working Conference

**For more information**:

Prof. Dr. Vidosav D. Majstorovic Jusk

Kneza Milosa 9/II

11000 Beograd

Yugoslavia

Phone/fax: +381 11 323 55 15

E-mail: majnem@EUnet.yu

**THIRD INTERNATIONAL SYMPOSIUM**

**on**

**TOOLS AND METHODS OF COMPETITIVE ENGINEERING**

**Delft, The Netherlands,**

April 18 - 21, 2000

The main focus of the TMCE 2000 Symposium and the accompanying workshop will be on competitive product conceptualization, detail design, engineering and production. The trends in all kinds of product related activities, such as global marketing, product conceptualization, concurrent and collaborative engineering, virtual and physical product modeling, product aesthetics and ergonomics, and development of design support systems based on new paradigms will be presented. It will also cover the development of enabling tools, such as VR, GM, FEM, RP, QFD, FMEA, LCA, AID, ISA, and PDM.

REGISTRATION FOR THE SYMPOSIUM:
You can find information on the symposium at
http://www.io.tudelft.nl/tmce2000/
including a program of all scheduled presentations at
http://www.io.tudelft.nl/tmce2000/tmce2000_preliminary_program.pdf
or contact the tmce2000 organising comittee:

ADDRESS AND COMMUNICATIONS:
TMCE 2000 Secretariat,
Delft University of Technology,

Faculty of Design, Engineering and Production

School of Industrial Design Engineering, IO BUILDING,

Jaffalaan 9 NL - 2628 BX Delft The Netherlands

Phone: +31 - 15 - 278 3520 or +31 - 15 - 278 3765

Fax: +31 - 15 - 278 7316 or +31 - 15 - 278 1839

E-mail: tmce2000@io.tudelft.nl

Web: http://www.io.tudelft.nl/tmce2000



# *Books and journals*

## Call for contributions to a new book

Prof. Dr.-Ing. **Herbert Schulz** of Darmstadt University of Technology will act as responsible editor for the new book "Scientific Fundamentals of High Speed Cutting". All colleagues, who work on the mentioned subjects are cordially invited to give a contribution. The table of contents is the following:

Chapter 1: Mechanism in the cutting zone
(chip building , plastomechanics, thermomechanics, FE simulation)
Chapter 2:Behaviour of Material (change of material characteristics, influence on surface and boundary zone)
Chapter 3: Wear mechanism (workpiece-tool, material)
Chapter 4: Tools (micro- and macrogeometry, cutting edge material, balancing)
Chapter 5: Cutting process (optimisation, safety)
Chapter 6: Influence of cutting technology on machine tools and its components

**Deadlines:**
Abstracts: 31. May 2000
Confirmation of acceptance: 31. July 2000
Final papers: 31. October 2000

All contribution will be reviewed by an international Scientific Committee.

The book will be published in English language.
Publication date: CIRP General Assembly 2001 and EMO machine tool exhibition, Hannover 2001

**Address:**
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Darmstadt University of Technology
Petersenstr. 30

D-64287 Darmstadt
Tel. +49 6151 16 21 56
Fax +49 6151 16 33 56
e-mail: schulz@ptw.tu-darmstadt.de

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**Computer Applications in Near Net-Shape Operations**
**Nee, A.Y.C., National University of Singapore**
**Ong, S.K., National University of Singapore**
**Wang, Y.G., Huazhong University of Science & Technology, Hubei, People's Republic of China**
**(Eds.)**

August 1999. XVII, 321 pp. 243 figs.
ISBN 1-85233-186-0
£ 65

Fields: Mechanical Engineering; Manufacturing; Machines and Tools
Written for: Libraries, institutes, graduate students
Book category: Monograph
Publication language: English

The process of producing components to final net-shapes is fast becoming a desirable goal for metal working industries. This is due to a combination of factors such as the development of new materials and escalating energy costs. Computer Applications in Near Net-Shape Operations addresses the design, analysis and simulation of near net-shape operations using some of the most advanced computer techniques and tools available. Topics covered include: Sheet metal forming operations: progressive stamping, fine blanking, nesting, flat pattering, bending and nibbling; Die design, construction and NC programming of wire EDM; Bulk metal forming processes such as cold upsetting and close-die forging; Injection mould design, analysis and simulation; Computer-aided design of CNC machines for near net-shape operations; Intelligent progressive die design system IPD. This collection of the latest developments from leading experts in the field will be of interest to practising engineers, graduate students and researchers of metal forming, stamping, mould and die design.

**Contents:**

Foreword.
Preface.
Contents.
List of Abbreviations.
List of Authors.
1. Introduction to near net-shape operations.
2. CAD/CAM for sheet metal forming and related processes.
3. CAD/CAM for massive (bulk) metal forming.
4. CAD/CAE/CAM for injection moulding.
5. FEM applications in near net-shape operations.

6. CAE/CNC of machines for near net-shape operations.
7. IMOLD: an intelligent mould design and assembly system.
8. Computer applications in intelligent progressive dies design (IPD).
Index.

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**Manufacturing Automation** Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design

**by Yusuf Altintas** University of British Columbia

Metal cutting is one of the most widely used methods of producing the final shape of manufactured products. This book treats the scientific principles of metal cutting and their practical application to solving problems encountered in manufacturing. The subjects of mathematics, physics, computers, software, and instrumentation are discussed as integration tools in analyzing or designing machine tools and manufacturing processes.
The book begins with the fundamentals of metal cutting mechanics. A special feature is the in-depth coverage of chatter vibrations, a problem experienced daily by practicing manufacturing engineers. The essential topics of programming, design, and automation of CNC (computer numerical control) machine tools; NC (numerical control) programming; and CAD/CAM technology are fully discussed. Each chapter includes examples drawn from industry, design projects, and homework problems.
Advanced undergraduate and graduate students, as well as practicing engineers, will find this book a clear and thorough way to learn the engineering principles of metal cutting mechanics, CNC system design, and CAD/CAM technology.
*"Overall, the manuscript is an excellent, detailed review of the principles of metal cutting and machine tool automation. It is obvious that the author has a comprehensive knowledge of these allied fields, and he has gone to considerable trouble to impart his own understanding of complex topics such as the dynamic deformation of machines and the design, analysis and control of CNC systems, to the enlightenment of the reader. Essentially, this manuscript has the potential to be a good textbook, which should fulfil the needs of both undergraduate and postgraduate students studying courses in the field of manufacturing automation or manufacturing systems."*
-- Professor J. B. Hull
Head of Department of Mechanical and Manufacturing Engineering
Nottingham Trent University

Cambridge University Press
March 2000, 304 pp.
Hardback $90.00 (ISBN 0-521-65029-1)
Paperback $39.95 (ISBN 0-521-65973-6)

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## Metal Machining: Theory and Applications

by

T.H.C. Childs, K Maekawa, T Obikawa and Y. Yamane

It will be published in April 2000 by Arnold Publishers for £35.
The publishers have agreed that the book can be sold at a 25% discount if you order it before 30 April. If you want to take up this offer please contact Andrew White at the following address, quoting 'Childs - Metal Machining author offer' with your credit card details.

Andrew White
Sales Manager
Arnold Publishers
338 Euston Road
London, NW1 3BH
UK
Fax: +(44) (0)207 873 6325 Email: andrew.white@hodder.co.uk

The price of the book with this offer will be £26.50. There will be a postage and package charge of approximately £4.00 for sales outside the UK.

The book has nine chapters, in effect ordered as a part I, (Chapters 1 to 5) that might be a general masters level text for mechanical engineers or mechanical options within a materials or production engineering masters course; and a part II (Chapters 6 to 9) that extend from masters to research and practising professional engineer level. The focus of the book is the metal removal process itself. Chapter 1 sets this in the broader machine tool and manufacturing systems and economics context. Chapter 2 contains sections on the mechanics of chip formation, heating in machining, and the friction, lubrication and wear conditions at the chip tool interface: in effect it is a review of analytical (classical) studies and experimental facts about the mechanics of machining. Chapter 3 has more of a materials emphasis. It is about workpiece mechanical and thermal material properties that determine the stresses and temperatures in machining; and about the tool geometry, mechanical and thermal properties needed for it not to fail: there is coverage of coated tool properties too. Chapter 4 is specifically on tool wear and Chapter 5 on experimental methods in machining. Chapter 6 extends the mechanics of Chapter 2 to consider slip-line field models of machining and the introduction of material properties influences associated mainly with Professor Oxley's work. It is a transition chapter to Chapter 7 which introduces finite element modelling of the machining process. Chapter 8 reviews achievements to date of finite element mechanical and thermal modelling. The final (and important) Chapter 9 is concerned with how process understanding and modelling can be used to improve process planning, monitoring and control. In addition there are 7 appendices: major ones on metal plasticity, heat transfer theory and tribology for machining; and shorter ones with tool and work material property data and an introduction to fuzzy logic.

Meetings, seminars and conferences | Go back to the Table of Contents | From the labs

# *From the Labs*

### Nanotech 500 Freeform Generator in Operation at the University of Bremen

The LFM Laboratory for Precision Machining of the University of Bremen, Germany, announces the acquisition of a Nanotech 500 Freeform Generator built by Moore Nanotechnology Systems, LLC. The Nanotech 500 is a 5-axis ultra-precision grinding and diamond turning machine capable

of generating axisymmetric and non-axisymmetric geometries in a range of materials including optical glasses, ceramics, hardened steel, non-ferrous metals and polymers. The machine comprises 3 hydrostatic linear axes (X = 300mm, Y = 200mm, Z = 300mm) with a resolution of 10nm and 2 air bearing rotary axes (B and C) with a resolution of 0.65 arc sec. The workpiece spindle can be operated as a free running axis up to 2000rpm or in feedback mode up to 100rpm. The novel design of the hydrostatic grinding spindle provides enhanced compliance and spindle speeds up to 40000rpm.
The Nanotech 500 Freeform Generator with 5 numerically controlled axes is the first machine of its kind worldwide. Modes of operation include contour grinding, raster grinding, diamond turning, fly-cutting and diamond milling of surfaces. It is hoped that this machine will pave the way for the deterministic generation of complex shapes in optical or near-optical quality.

More information from:

Labor fuer Mikrozerspanung
Badgasteiner Strasse 2
D-28359 Bremen
Germany
Tel.: +49-421-218-9440 Fax : +49-421-218-9441 E-mail: lfm@lfm.uni-bremen.de

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**Special Research Area 489**
**"Process Chain for the Production of Precision Forged High Performance Components"**

The authoritative committee of the Deutsche Forschungsgemeinschaft (DFG) for the promotion of special research areas has decided about the establishment and financing of the special research area 489 - "Process Chain for the Production of Precision Forged High Performance Components" on its meeting on the 23rd and 24th of November 1999. This research project started on January 1st, 2000. Head of the project is Prof. Dr.-Ing. Eckart Doege of the Institute for Metal Forming and Metal Forming Machine Tools (IFUM) University of Hanover.

In the course of this research project ten sub-projects will be worked on:

- materials for precision forging
- advanced models of simulation and their integration into the CEA-chain
- forming and simulation of controlled cooling of precision forged parts
- Process design and process management at precision forging
- machine and tool technology for precision forging
- process integrated heat treatment with two-phase flow
- hard-fine finishing of precision forged components
- non-destructive examination of components inside the process chain "precision forging"

- estimation and configuration of the process chain with logistic characteristic curves
- planning and control of flexible supply chain for the production of precision forged components

For further information about the SFB 489 please contact Mr. Dipl.-Ing. Hornhardt under the following e-mail address: hornhardt@office.ifum.uni-hannover.de.

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# *Miscellaneous*

**UNIVERSUM SCIENCE CENTER BREMEN, GERMANY**

One of Bremen's most fascinating projects for the World Exposition EXPO 2000 in Hannover has announced its opening for September 9th, 2000. The Universum Science Reality Center near the campus of the University of Bremen will provide real hands-on insights into the world of scientific discovery. More than 200 interactive exhibits and zones will vividly and understandably present accomplishments in scientific research and technological innovations, inviting visitors to marvel, experiment and be part of expeditions centering around the themes of earth, mankind, and cosmos. The extraordinary architecture of the Science Center, imitating the shape of a whale surfacing from a 7,000 sqm artificial lake, will intrigue an estimated 300,000 people per year to venture inside and explore the fascinating phenomena of the universe.
The Science Reality Center is complemented by the Atlantic Hotel Universum and the Science Conference Center, whose state-of-the-art multimedia conference technology opens up new perspectives for contemporary communication and information, both national and international. In organizing this EXPO project the University of Bremen hopes to bridge the gap between academic research and public understanding of science. A team of 30 university professors will continuously work on keeping the exhibits up-to-date.

Prof. Dr.-Ing. habil. E. Brinksmeier
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Email: brinks@iwt.uni-bremen.de

For more information on the UNIVERSUM SCIENCE CENTER BREMEN, please contact:

Dr. Martin Mehrtens
Bibliothekstraße 1
28359 Bremen
Germany
Phone: ++49-421-218-3900
Fax: ++49-421-218-4782

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CIRP officers inspecting the lower level of the new CIRP office to determine its suitability as a wine cellar

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From the Labs