

*The North American Manufacturing Research
Institution of the Society of Manufacturing Engineers
Invites You to Attend the*

Twenty-Third North American Manufacturing Research Conference

NAMRC XXIII
May 24-26, 1995



NAMRI SME®

*Sponsored by the North American Manufacturing Research
Institution of the Society of Manufacturing Engineers*

Hosted by
Michigan Technological University
Houghton, Michigan, USA



Dear Colleague:

Michigan Technological University is pleased to serve as host for the Twenty-Third North American Manufacturing Research Conference. This year, 91 papers will be presented at the conference from universities, research institutes, and industrial research laboratories from around the world. All of these papers have been accepted based on a peer review process conducted by the NAMRI/SME Scientific Committee.

The conference will begin on Wednesday, May 24, with a presentation by Father William T. Cunningham, Executive Director of Focus: HOPE, who will present his thoughts on the development of renaissance engineers. Professor Branimir von Turkovich will give the now-traditional Founder's Lecture during the Wednesday luncheon. Johnson Controls, Inc., will serve as the host for the conference banquet, to be held on Wednesday evening.

We want to extend a special invitation to attend the conference to our colleagues from industry. Your input is a valuable and necessary component to the dialogue that takes place at NAMRC. Be assured that we will strive to make your visit to Michigan Tech and the Copper Country both pleasant and technically stimulating.

We look forward to meeting old and making new friends at NAMRC XXIII, and invite you to do the same. We believe that you will both enjoy and benefit from the experience.

Cordially,

John Sutherland and Klaus Weinmann, Co-Chairs
NAMRC XXIII Organizing Committee

What Is NAMRC?

NAMRC is an international forum for the presentation and critical discussion of the results of basic and applied research in material forming, material removal and manufacturing systems and controls. It is one of only a few events of its kind where technical innovations, new methods, and applications of leading-edge technology from throughout the world are shared between manufacturing research, design, engineering and production professionals from academia and industry. Because NAMRC takes place every year, the findings and breakthroughs presented here are topical and of current interest.

Why Should You Attend?

By attending NAMRC XXIII you will:

- Gain insight on the most recent developments in material removal and forming processes, automation and control of processes and systems, equipment accuracy and precision, and many other manufacturing-related topics.
- Participate in a dialogue between industry and academia on future needs for manufacturing processes and applications.
- Make valuable contacts with other leading manufacturing researchers and professionals.

About NAMRI

The North American Manufacturing Research Institution of the Society of Manufacturing Engineers (NAMRI/SME) is an organization dedicated to manufacturing research and technology development. Its mission is to provide manufacturing professionals with a means to exchange ideas and share findings with leading researchers in the field of manufacturing.

NAMRI/SME is administered through the Society of Manufacturing Engineers, an international professional society dedicated to serving its members and the manufacturing community through the advancement of professionalism, knowledge and learning.

Program-at-a-Glance

	07:50-08:50	08:50-10:00	10:00-10:50	10:50-12:00	12:00-13:50	13:50-15:00	15:00-15:50	15:50-17:00	Evening
Tuesday									Conference Registration/ Reception (17:00-21:00)
Wednesday	Registration and Continental Breakfast	Opening Ceremony and Keynote Address	Break	Concurrent Sessions	Lunch: Founders Lecture "Fifty Years of Chip Making"	Concurrent Sessions	Break	Concurrent Sessions	Conference Banquet (18:30-22:30)
Thursday	Registration and Continental Breakfast	Concurrent Sessions	Break	Concurrent Sessions	NAMRI Awards Luncheon	Concurrent Sessions	Break	Lab Tour: ME-EM Building	Wine and Cheese Reception (17:00-18:30) NAMRI/SME Membership Meeting (18:30-19:30) ASME Production/ Manufacturing Engineering Division Mtg. (19:30-20:30)
Friday	Registration and Continental Breakfast	Concurrent Sessions	Break	Concurrent Sessions	Light Lunch/ Conference Adjourns	Quincy Mine Tour			

Conference Site

The site for NAMRC XXIII is Michigan Technological University, Houghton, Michigan. The MTU campus is located approximately 10 miles from Lake Superior and stretches for a mile along the Keweenaw Waterway. Approximately 12,000 people live in Houghton and its sister city, Hancock, in the heart of Upper Michigan's scenic Keweenaw Peninsula. Surrounded by recreational areas of forests, lakes, and hills, the Houghton-Hancock area provides an ideal family vacation destination. Many sights are within a short driving distance, including historic Fort Wilkins, picturesque Copper Harbor, spectacular Brockway Mountain, beautiful Lake Superior, numerous waterfalls, and McLain State Park. Recreational activities available include swimming, golfing, boating, fishing, wind surfing, camping, and hiking.

The annual conference banquet will be hosted by Johnson Controls, Inc., and will be held on the evening of Wednesday, May 24, at the Historic Onigaming Restaurant. Formerly a private yacht club, the Onigaming's ambience is nautical and casual, with diners frequently arriving by boat. The restaurant also provides a superb view of Portage Lake. Transportation to and from the banquet will be provided.



NAMRC XXIII – May 24-26, 1995

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Publications

All the papers to be presented at NAMRC XXIII will be contained in either the hard bound "Transactions of the North American Manufacturing Research Institution of SME, Volume 23, 1995" or in the soft cover "Technical Papers of the North American Manufacturing Research Institution of SME - 1995." Participants who have paid the full registration fee will receive copies of each at the time of registration. Additional copies of the publications may be purchased at registration for \$65 and \$30 respectively. After the conference, they may be purchased through SME Customer Service at 1-800-733-4763.

Facilities

The program sessions will be held in Fisher Hall, which is centrally located on campus. Lunches will be held in the Memorial Union Building. Arrangements have been made for the conference participants to use the facilities at the Student Development Complex (SDC). The SDC facility is equipped for swimming, basketball, tennis, jogging, etc.

Registration Fees

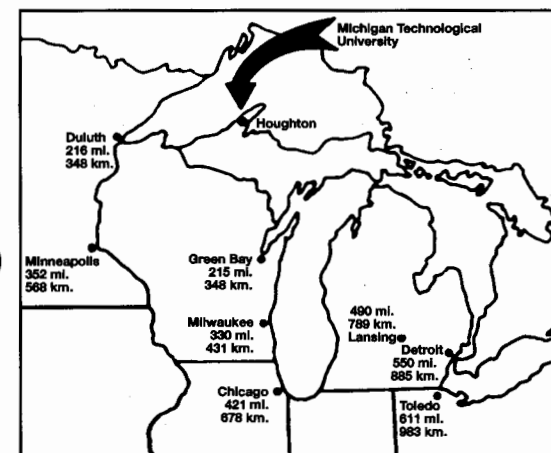
Registration fees for the full conference are \$295 for registrations postmarked or faxed (with credit card information) on or before May 10, and \$320 after that date. The one day registration fee is \$185 including all NAMRC meals and the conference publications. Student/retiree registration is \$50 and includes all NAMRC meals. There are no reduced registrations for authors or session chairs. Fees are refundable for cancellations received up to five working days prior to the start of the conference. Cancellations after this date, but prior to the start of the conference, will be assessed a \$50 cancellation charge. No refunds will be given after the start of the conference.

Guest Program

A non-technical program will be provided on Wednesday, May 24, and Thursday, May 25, for visiting spouses, guests and others who do not wish to attend the technical sessions. The program will offer visits to the Seaman Mineral Museum, historic turn-of-the-century Calumet Theatre, Lake Superior, Copper Harbor and other local attractions.

Travel

Houghton is served by Northwest Airlink from Minneapolis (3 flights daily) and Detroit (3 flights daily) at the Houghton County Memorial Airport (CMX) in Hancock, Michigan. Transportation will be arranged to and from the airport. Limousine service is also available to and from the airport.



Houghton may be reached by car via scenic routes. Houghton is a six hour drive from Minneapolis, an eight hour drive from Chicago, and a ten hour drive from Detroit. Free parking will be available to those who drive. Most of the conference motels are a short walk (3/4 mile) from the University campus.

Parking

Parking will be provided on campus, adjacent to and east of Fisher Hall, in lot 14. A permit is not necessary.

Lodging

For overnight accommodations, we suggest the following motels:

*Best Western Franklin Square Inn	(906) 487-1700	\$56
*Best Western King's Inn	(906) 482-5000	\$46
Houghton Super 8	(906) 482-2240	\$42
College Motel	(906) 482-2202	\$36

Please make your reservations by calling the motel of your choice directly. The above rates are for one person, do not include tax, and are subject to change. The Franklin Square Inn and King's Inn have rooms blocked for this event. Registration and the Welcoming Reception will be held at the Franklin Square Inn on Tuesday evening, May 23.

If you would like information on additional motels or campus housing, please call the Michigan Technological University Conference Department at (906) 487-2263.

Transportation to and from the conference functions will be provided from these motels.

Post-Conference Events

The Keweenaw Peninsula possesses beautiful scenery and also has a number of historical sites. The area was the site of the first mining boom in the United States. As a result, the area abounds with landmarks and industrial archeological sites.

Keweenaw National Historical Park

During Friday's lunch, a presentation will be given by Bill Fink, Superintendent of the Keweenaw National Historical Park, on the development and preservation of the region's history.

Quincy Mine Tour

The mineral largely responsible for the area's mining boom was copper, and several local mines are still in use. On Friday afternoon a tour has been arranged of the world-famous Quincy Mine, led by Mike LaCourt of the ME-EM and Mining Departments. A sign-up sheet for the tour will be available at the conference registration desk. It is suggested that people attending the tour wear clothing suitable for climbing/walking in damp, cool conditions.

Weather

The weather in the "Copper Country" in late spring can be unpredictable. The evenings are often cool, and conference attendees are urged to bring a jacket.

To Register

Complete the registration form at the back of this brochure, include the proper fees, and mail or fax to:

Michigan Technological University
Attn: Cashier
1400 Townsend Drive
Houghton, MI 49931-1295
Fax: (906) 487-3533

If you have any questions, please call the MTU Conference Department at (906) 487-2263.

NAMRC XXIII Technical Sessions and Programs

Tuesday, May 23

17:00 - 20:00

Conference Registration: Lobby of the Franklin Square Inn

17:00 - 21:00

Reception: Franklin Square Inn - Lake Superior Room

Wednesday, May 24

07:30 - 08:30

Registration and Continental Breakfast: Fisher Hall

08:30 - 10:00

Opening Ceremony: Fisher Hall Room 135

Opening Remarks:

J.W. Sutherland, Co-Chair of Organizing Committee
K.J. Weinmann, Co-Chair of Organizing Committee

Welcoming Remarks:

C.J. Tompkins, President, Michigan Technological University
E. Lumsdaine, Dean, College of Engineering, Michigan Technological University

Introductory Remarks:

D.R. Durham, NAMRI/SME President

Keynote Address:

"Developing the Renaissance Engineer"
Father William T. Cunningham
Executive Director of Focus: HOPE

Father Cunningham, founder of Focus: HOPE, a nationally recognized manufacturing apprenticeship program that has been training Detroit youth since 1967, will present his thoughts on the development of renaissance engineers.

10:30 - 12:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)**A1: Forming** *Room 101*Co-Chairs: **J.A. Pale**, Mascotech Forming Technologies - Braun
K. Stelson, University of Minnesota**Investigating the Cold Forming of Precision Parts**, S. Kini and R. Shivpuri, Ohio State University**An Expert System for Roll Pass Design in Shape Rolling of H-Beams**, K. Mori, K. Osakada and M. Kobayashi, Osaka University**Chatter in Rolling**, I.S. Yun, W.R.D. Wilson and K.F. Ehmman, Northwestern University**B1: Grinding** *Room 138*Co-Chairs: **K. Subramanian**, Norton Company
D. A. Lucca, Oklahoma State University**Study on the Grinding of Polycrystalline Diamond with Slotted Diamond Wheels**, X. Ai and J.H. Zhang, Shandong University of Technology**Problems of Flatness in Plane Surface Grinding**, G. Spur and A. Funck, Technical University of Berlin**Measurement of Hydrodynamic Forces in Grinding**, M. Garesan, C. Guo, and S. Malkin, University of Massachusetts - Amherst**C1: Waste Streams** *Room 139*Co-Chairs: **B. Gockel**, Sandia National Laboratory
B. Kramer, National Science Foundation**An Analysis of Chip Curl Development, Chip Deformation and Chip Breaking in Orthogonal Machining**, I.S. Jawahir and J. Zhang, University of Kentucky**Development of a Scoring Index for the Evaluation of Environmental Factors in Machining Processes: Part I - Health Hazard Score Formulation**, M. Srinivasan, University of California - Berkeley, T. Wu, Carnegie Mellon University, and P. Sheng, University of California - Berkeley**Development of a Scoring Index for the Evaluation of Environmental Factors in Machining Processes: Part II - Applications**, M. Srinivasan, University of California - Berkeley, T. Wu, Carnegie Mellon University, and P. Sheng, University of California - Berkeley**D1: Manufacturing Systems** *Room 135*Co-Chairs: **J. Ni**, University of Michigan
J. Agapiou, General Motors Corporation**Selectively Reinforced Composites Using Photolithography**, R. Charan, T. Renault, A. Bagchi and A.A. Ogale, Clemson University**On-Line System Identification and Control of a Thick Film Printing Process Using Neural Network**, S.C. Bose and R.A. Balderas, University of Texas - PanAm**Tonnage Signature Analysis Using the Orthogonal (Haar) Transforms**, C.K.H. Koh, J. Shi and W.J. Williams, University of Michigan**12:00 - 13:30 Lunch: Memorial Union Ballroom**Founder's Lecture
"Fifty Years of Chip Making"
B. F. von Turkovich, University of Vermont

13:30 - 15:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)**A2: Extrusion** *Room 101*Co-Chairs: **G. D. Lahoti**, Timken Company
M.L. Devenpeck, ALCOA**Computer Simulation of Hollow Extrusion and Drawing Using 3D-FEM**, J.S. Gunasekera and Z. Jia, Ohio University**Extrusion of Flat Bars, Angles and Channels: Three-Dimensional Analysis of Metal Flow by Rigid-Plastic Finite Element Method**, M. Kiuchi, J. Yanajimoto and V. Mendoza, University of Tokyo**Forward-Backward Extrusion Type Friction Testing Method**, T. Nakamura, Shizuoka University and I. Ishibashi, Sumico Lubricant Co., Ltd.**B2: Finishing Processes** *Room 138*Co-Chairs: **J. Leopold**, GFE-IWQ-Bereich Chemnitz
E. Kannatey-Asibu, Jr., University of Michigan**Surface Integrity Improvement of EDM Components by Ultrasonic Polishing**, B.J. Allen and R.E. Williams, University of Nebraska - Lincoln, and J.R. Gilmore, Extrude Hone**An Experimental Investigation of Rotary Ultrasonic Grinding of Ceramic Disks**, N. Khanna, Z. Pei and P.M. Ferreira, University of Illinois at Urbana - Champaign**Analysis of Acoustic Emission Signals During Pendular Scratching of Fine Ceramics**, J. Akbari, Seiko Seiki Co. Ltd., Y. Saito, S. Higuchi and T. Hanaoka, Chiba University

C2: Assembly/Disassembly

Room 139

Co-Chairs: **M.L. Philpott**, University of Illinois at Urbana - Champaign
P. Sheng, University of California - Berkeley

Variation Simulation For Deformable Sheet Metal Assemblies Using Mechanistic Models, S.C. Liu, H.W. Lee and S.J. Hu, University of Michigan

Optimization of Multiple Panel Fitting in Automobile Assembly, D. Khorzad, J. Shi, S.J. Hu and J. Ni, University of Michigan, E. Zussman and G. Seliger, Technical University of Berlin

Computer-Aided Mechanical Disassembly Sequence Generation, K.K. Kurup, S. Raman and P.S. Pulat, University of Oklahoma

D2: Tool Life/Replacement

Room 135

Co-Chairs: **E. Exner**, Ford Motor Company
S.N. Melkote, Georgia Institute of Technology

Evolution of Tool-Life Relationships-Shapes, Accuracy and Applications,
 B.N. Colding, Colding International Corporation

Tool Life and Workpiece Surface Integrity Evaluations When Machining Hardened AISI H13 and AISI E52100 Steels with Conventional Ceramic and PCBN Tool Materials, A.M. Abrao, D.K. Aspinwall and M. L.H. Wise, University of Birmingham

Tool Replacement Strategies and the Precision of Tool Monitoring System in Advanced Manufacturing System, Z. Tang, S. Noto la Diega and A. Passannanti, Universita di Palermo

15:00 - 15:30

Coffee Break: Fisher Hall

15:30 - 17:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A3: Forming Accuracy

Room 101

Co-Chairs: **W.R.D. Wilson**, Northwestern University
J. Brevick, Ohio State University

Simulation of Forming Sequence of Pressure-assisted Injection Forging of Thick-walled Tubes, Y. Qin and R. Balendra, University of Strathclyde

Numerical Investigation of the Effect of Gate Velocity and Gate Size on the Quality of Die Casting Parts, K. Venkatesan and R. Shivpuri, Ohio State University

Inclining Accuracy of Staked Shaft on Plate, Y. Nakajima, K. Ueno and H. Kaneko, Hitachi, Ltd.

B3: Wear and Fracture

Room 138

Co-Chairs: **C.H. Shen**, General Motors Corporation
S. Malkin, University of Massachusetts - Amherst

Influence of Grinding Direction on Fracture Strength of Silicon Nitride, T.J. Strakna, S. Jahanmir, National Institute of Science and Technology, R.L. Allor, Ford Motor Company and K.V. Kumar, General Electric Superabrasives

Wear Mechanisms Prevalent During Sideface Grinding of an Aerospace Material, R.B. Mindek, Jr. and T.D. Howes, University of Connecticut

Chipping of Sharpened, Nitrided Spool Valve Edges: Problem Diagnosis and Solutions, H. Gupta, T.D. Howes and T. Doggart, University of Connecticut

C3: Mechanics of Cutting

Room 139

Co-Chairs: **R.P. Khetan**, General Motors Corporation
J. Vogel, University of Minnesota

Phase Difference and Its Sensitivity Analysis for a Nonlinear Difference-differential Machining Chatter Model, H. Zhang and J. Ni, University of Michigan

Analysis of End Milling Forces with Cutter Axis Tilt, L. Zheng and S.Y. Liang, Georgia Institute of Technology

Tool Breakage Detection in End-Milling: A DDS Approach, S. M. Pandit, D. Paul and J.T. Roth, Michigan Technological University

D3: Manufacturing Systems

Room 135

Co-Chairs: **A. Sabroff**, Eaton Corporation
Y. Shin, Purdue University

A Theoretical and Experimental Investigation of Position Based Force and Impedance Control for Industrial Robots, D. Surdilovic and G. Duelen, Elektrotechnik und Wirtschaftsingenieurwesen

Analysis of Radial Brush Behavior Using Single Bristle Dynamical Model, V. G. Hatman, A. Bagchi and I. Haque, Clemson University

Dual Beam Laser Systems and Their Impact on Weld Pool Convection and Surface Deformation, T.C. Chen and E. Kannatey-Asibu, Jr., University of Michigan

18:30 - 22:30

Conference Banquet: Onigaming Restaurant
 (hosted by Johnson Controls, Inc.)

Van transportation to and from banquet will be provided, with pickup from the Franklin Square and King's Inns.

Thursday, May 25

07:30 - 08:30

Registration and Continental Breakfast: Fisher Hall

08:30 - 10:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A4: Innovations in Forming

Room 101

Co-Chairs: K.F. Ehmann, Northwestern University
R. Shivpuri, Ohio State University

Systems Analysis for Laser Forming, F. Vollertsen and M. Geiger, LFT University of ERL.NBG

Dieless Forming Technique for Heat Exchangers, T. Amimoto, M. Taniguchi, M. Kuragano and H. Murakami, Hitachi Ltd.

New Processing Technologies for Aluminium Wrought Alloys and Magnesium Superlight Alloys, E. Doege, M. Papke and W. Polley, Universitat Hannover

B4: Planning/Control of Machining

Room 138

Co-Chairs: P. Bandyopadhyay, General Motors Corporation
S.Y. Liang, Georgia Institute of Technology

An Optimal Piecewise Curve-fitting Approach for CNC Machining, Y.S. Wong, H.T. Loh and C.S. Teng, National University of Singapore

Automatic Selection of the Optimum Metal Removal Conditions for High-Speed Milling, W.R. Winfough, Ingersoll Milling Machine Company and S. Smith, University of Florida

Hybrid Control of a Planar 3-DOF Parallel Manipulator for Machining Operations, S.M. Satya, P.M. Ferreira and M.W. Spong, University of Illinois at Urbana-Champaign

C4: Cutting Fluids

Room 139

Co-Chairs: J.M. Panetta, Ford Motor Company
M.A. Elbestawi, McMaster University

Cutting Fluids in Grinding of Advanced Ceramics, G. Spur and T. Brucher, Technical University of Berlin

The Effect of the Coolant Flow Rate on Cooling in Machining, X. Li, National University of Singapore

A Study of the Cutting Temperatures in Machining Processes Cooled by Liquid Nitrogen, Y. Ding and S.Y. Hong, Wright State University

D4: Residual Stresses

Room 135

Co-Chairs: B. Wei, University of Nebraska - Lincoln
T.R. Kurfess, Georgia Institute of Technology

Manufacture of Spherical and Aspheric Surfaces on Plastics, Glass, and Ceramics, V.C. Venkatesh and Z. Zhong, Nanyang Technological University

A New Method to Estimate Workpiece Residual Stress, Y.Y. Li, Z.K. Yao, S. Zhou and S.S. Zhou, University of Connecticut

A Feasibility Assessment of Residual Stress Measurement by an Ultrasonic Technique, T.L. Nguyen, E.S. Furgason and Y. Shin, Purdue University

10:00 - 10:30

Coffee Break: Fisher Hall

10:30 - 12:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A5: Forming

Room 101

Co-Chairs: Z. Pavlov, Allied Tube and Conduit Corp.
A. Chandra, University of Arizona

Deep Drawing and Reverse Redrawing of Aluminum Alloy Cups, M.A. Ahmetoglu, J. Brandelstein, G.L. Kinzel and T. Altan, Ohio State University

Experimental and Finite Element Study of Sheet Metal Flow in a Strip Test Apparatus with Controllable Drawbead Penetration, J.R. Michler and K.J. Weinmann, Michigan Technological University

Tolerance Analysis of Three-Dimensional Tube Bending: Worst Case and Statistical Methods, K.A. Stelson and H. Lou, University of Minnesota

B5: Manufacturing Systems

Room 138

Co-Chairs: W.R. DeVries, National Science Foundation
E.C. De Meter, Pennsylvania State University

A New Heuristic Algorithm for Sequence-Dependent Setup Problems, A. Kazerooni, K. Abhary and F.T.S. Chan, University of South Australia

Developing an Integrated Framework for the Design of Manufacturing Systems Using the Genetic Recombination Technique, H.A. Rao and P. Gu, University of Calgary

Heterarchical FMS Control Using Petri Net Based Modeling, Y.G. Han and I. Ham, Pennsylvania State University

C5: Repeatability and Process Capability *Room 139*

Co-Chairs: **A. Herman**, Ford Motor Company
R. Wilhelm, University of North Carolina - Charlotte

Measuring Robot Repeatability: Investigating Experimental Uncertainty, R.D. Helferty and J. Jeswiet, Queens University

A Quantitative Methodology for Process Capability Analysis of Turning Centers, J. Salsbury and J. Raja, University of North Carolina - Charlotte

Capability Indices - Somewhere the Point Got Lost, W.A. Berezowitz, General Electric Corp. and T.H. Chang, University of Wisconsin - Milwaukee

D5: Non-Traditional Material Removal *Room 135*

Co-Chairs: **R.E. Williams**, University of Nebraska - Lincoln
M. Hashish, QUEST Integrated, Inc.

Simulation and Experimental Investigation of Smoothing by Electrochemical Machining, A. Chatterjee, J. Kozak and K.P. Rajurkar, University of Nebraska - Lincoln

On-Line Monitoring of Process Variables in Peripheral Electrochemical Grinding, A. Geddam, City Polytechnic of Hong Kong

Micro-Precision Wire EDM; How It Can Be Achieved, D.F. Dauw, I.I. Leuven and I. Beltrami, AGIE

12:00 - 13:30

NAMRI/SME Awards Luncheon: Memorial Union Ballroom

13:30 - 15:00

Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A6: Forming *Room 101*

Co-Chairs: **S. Hayward**, Ford Motor Company
D.A. Dornfeld, University of California - Berkeley

Numerical Modelling of Superplastic Forming: Some Problems on the Thinning Evaluation, L. Carrino, G. Giuliano and S. Pistilli, University of Cassino

Process-Structure Relationships in the Warm Forging of Microalloyed Steels, R. Shivpuri and A. Deshpande, Ohio State University, T. Ishikawa, Nagoya University

Prediction and Elimination of Ductile Fracture in Cold Forgings Using FEM Simulations, H. Kim, M. Yamanaka, Yamanaka Engineering Co., Ltd. and T. Altan, Ohio State University

B6: Processing of Ceramics *Room 138*

Co-Chairs: **P.M. Ferreira**, University of Illinois at Urbana - Champaign
J.A. Webster, University of Connecticut

Grinding Damage in Ceramic Workpieces, S.S. Liang and O.F. Devereux, University of Connecticut

Inner Diameter Grinding of Advanced Ceramics with Vitrified Diamond Wheels, H.K. Tonshoff and J. Peddinghaus, University of Hannover

Influence of the Material Properties on the Honing of Ceramics, G. Spur and U.P. Weigmann, Technical University of Berlin

C6: Machine Tools *Room 139*

Co-Chairs: **M. Elwell**, Caterpillar Inc.
J.I. Mou, Arizona State University

Development of a CAM System for 5-Axis Controlled Machine Tools, H. Suzuki and A. Hayashi, Kyushu Institute of Technology, Y. Takeuchi, University of Electro-Communications and M. Sato, Makino Milling Machine Co., Ltd.

Autonomous Operation Planning with the Identification of Machine Tool Characteristics, T. Matsumura, H. Sekiguchi and E. Usui, Tokyo Denki University

Machine Tool Performance Testing, A Comparative Study, R.G. Wilhelm, N. Srinivasan and F. Farabaugh, University of North Carolina - Charlotte

D6: Sculptured Surface Machining *Room 135*

Co-Chairs: **M. King**, Allied Signal Aerospace
S.G. Kapoor, University of Illinois at Urbana-Champaign

Characteristics of Filleted Endmill in Precision Machining of Sculptured Surface, B.H. Kim and C.N. Chu, Seoul National University

Preliminary Experiments for Adaptive Finish Milling of Die and Mold Surfaces with Ball-nose End Mills, W.R. Gaida, Technical University of Aachen, C.A. Rodriguez and T. Altan, Ohio State University, and Y. Altintas, University of British Columbia

Two Polishing Models for the Single-Setup Machining of Free Form Mold and Die Surfaces, S. Modi, P.A. Green and M.L. Philpott, University of Illinois at Urbana - Champaign

15:00-15:30

Coffee Break: Fisher Hall

15:30-17:00

Laboratory Tour: ME-EM Building

17:00-18:30

Wine and Cheese Reception at President Tompkins' Residence

18:30-19:30
NAMRI/SME Membership Meeting: Room 112 ME-EM Building

19:30-20:30
**ASME Production/Manufacturing Engineering Division Meeting:
 Room 112 ME-EM Building**

Friday, May 26

07:30 - 08:30
Registration and Continental Breakfast: Fisher Hall

08:30 - 10:00
Four Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A7: Modelling and Control in Forming *Room 101*

Co-Chairs: **S.J. Hu**, University of Michigan
B.E. Klamecki, University of Minnesota

Feedback Control of the Sheet Metal Forming Process Using Drawbead Penetration as the Control Variable, J.R. Michler and M.L. Bohn, Michigan Technological University, A.R. Kashani, University of Dayton, and K.J. Weinmann, Michigan Technological University

Fuzzy Controlled Variable BHF Technique for Circular Cup Deep Drawing of Aluminum Alloy Sheet, K. Manabe, S. Yoshiara, M. Yang and H. Nishimura, Toyko Metropolitan University

Methods for Modelling Cold Roll Forming of Sheet, J.L. Duncan, S.M. Pantan and S.D. Zhu, Auckland University

B7: Part Orientation and Fixturing *Room 138*

Co-Chairs: **T.S. Babin**, Motorola, Inc.
J. Raja, University of North Carolina - Charlotte

Quantification of Errors in Rapid Prototyping Processes, and Determination of Preferred Orientation of Parts, M. Bablani and A. Bagchi, Clemson University

A Preliminary Investigation Into the Use of Metafunctions for the Dynamic Analysis of Workpiece Displacement Within a Machining Fixture, M.J. Hockenberger and E.C. De Meter, Pennsylvania State University

Prediction of the Reaction Force System for Machining Fixtures Based on Machining Process Simulation, S.N. Melkote, Georgia Institute of Technology, S.M. Athavale, R.E. DeVor, S.G. Kapoor and J.J. Burkey, University of Illinois at Urbana - Champaign

C7: Inspection *Room 139*

Co-Chairs: **S. Vadrevu**, Modern Engineering
S. Raman, University of Oklahoma

An Illumination Model for CAD Directed Vision Inspection, J.S. Sallade and M.L. Philpott, University of Illinois at Urbana - Champaign

Development of a Surface Finish Sensor for Machine Tool Applications, S. Varghese, N. Achuthan and V. Radhakrishnan, Indian Institute of Technology

Phase Shift Estimation: A Method for Improving the Accuracy of Phase Shift Interferometers, E.J. Salisbury, K.S. Moon and J.W. Sutherland, Michigan Technological University

D7: Sensor Issues *Room 135*

Co-Chairs: **W.J. Endres**, University of Michigan
Y. Lee, Hongyang University, Korea

Sensor-Based Planning and Control for Open Architecture Machining, R. Teltz, K. Urbasik, A. Shawky and M.A. Elbestawi, McMaster University

Sensor-Based Real Time Validation of Local Scripts and Global Models, D.A. Dornfeld and P.K. Wright, University of California - Berkeley

10:00 - 10:30
Coffee Break: Fisher Hall

10:30 - 12:00
Three Concurrent Technical Sessions: Fisher Hall (rooms as noted)

A8: Metal Forming *Room 101*

Co-Chairs: **C. Sa**, General Motors Corporation
M. DeVries, University of Wisconsin - Madison

Central Bursting Defects in the Drawing Process of Copper Specimens: Numerical Predictions and Experimental Tests, N. Alberti, C. Borsellino, F. Micari and V.F. Ruisi, University of Palermo

Computer Modelling of Microstructural Evolution in the Block Upsetting of Hot Steel, S.G. Xu, Michigan Technological University, Q.X. Cao, Tsinghua University, Beijing, K.J. Weinmann and S.A. Majlessi, Michigan Technological University

Development of Guidelines to Prevent Internal Cracking During Induction Heating of Cold Forged Parts, R. Shivpuri and P. Pauskar, Ohio State University

B8: Turning

Room 138

Co-Chairs: **W.R. Winfough**, Ingersoll Milling Machine Company
J.D. Sickinger, Caterpillar, Inc.

Hard Turning - Influences on the Workpiece Properties, H.K. Tonshoff,
 H. Wobker and D. Brandt, University of Hannover

Integrated Simulation and Stochastic Optimization Model for a Turning Process, Y. Lee, Hongyang University, K.S. Moon and K.V. Domala,
 Michigan Technological University

Approximations for Efficient Analytical Computation of Effective Lead Angle in Turning, Boring and Face Milling Models, W.J. Endres,
 University of Michigan

C8: Product and Process Design

Room 139

Co-Chairs: **P. Killgear, Jr.**, Ford Motor Company
L.A. Kendall, University of Minnesota - Duluth

A User Interface for Manufacturing Cost Data at the Early Product Development Stages, E.A. Branstad, H. Ronneberg and M.L. Philpott,
 University of Illinois at Urbana - Champaign

A Metric for Part Design and Manufacturing Information Exchange Efficiency in Concurrent Engineering, P. Bannerjee and D. Majumdar,
 University of Illinois - Chicago

12:00 - 13:30

Light Lunch: Fisher Hall

(Presentation by Bill Fink, Superintendent, Keweenaw National Historical Park)

Conference Adjournment

Quincy Mine Tour - led by M. LaCourt, Michigan Technological University

Registration Form

NAMRC XXIII
Michigan Technological University
May 24-26, 1995



(Duplicate this form for additional registrations.)

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