

The North American Manufacturing Research Institution  
of the Society of Manufacturing Engineers Announces its...

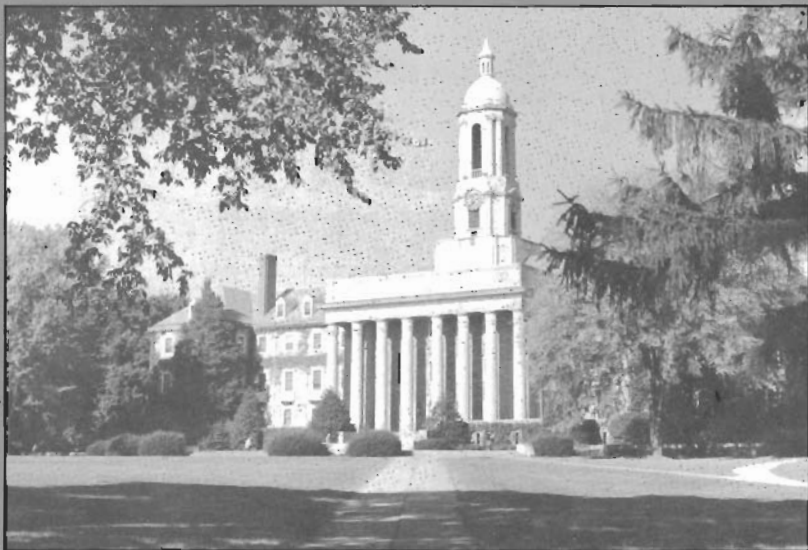
## **EIGHTEENTH NORTH AMERICAN MANUFACTURING RESEARCH CONFERENCE**



**NAMRC XVIII  
May 22-25, 1990**

Including the

**CIRP International Working Seminar  
on Artificial Intelligence Based Product Design  
May 22, 1990**



The Pennsylvania State University  
University Park, Pennsylvania USA

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THIS COMMITTEE ALSO INCLUDES THE ENTIRE  
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# EIGHTEENTH NORTH AMERICAN MANUFACTURING RESEARCH CONFERENCE—NAMRC XVIII

## REGISTRATION AND GENERAL INFORMATION

### NAMRC XVIII CONFERENCE PROSPECTUS

The Eighteenth North American Manufacturing Research Conference (NAMRC XVIII), to be held May 22-25, 1990, is designed to provide a forum for the timely presentation and critical discussion of the results of basic and applied research in material forming, material removal, and manufacturing systems/automation. All papers presented at the conference are contained in the bound volume titled "Transactions of the North American Manufacturing Research Conference 1990." These papers have been accepted based upon a review of the papers in their full length form and highlight manufacturing research efforts from universities, centers, and companies from around the world.

The conference will feature three parallel sessions in material forming, material removal, and manufacturing systems. The sessions will include formal presentations of the papers and a discussion period following each presentation. We urge you to attend and actively participate in these sessions.

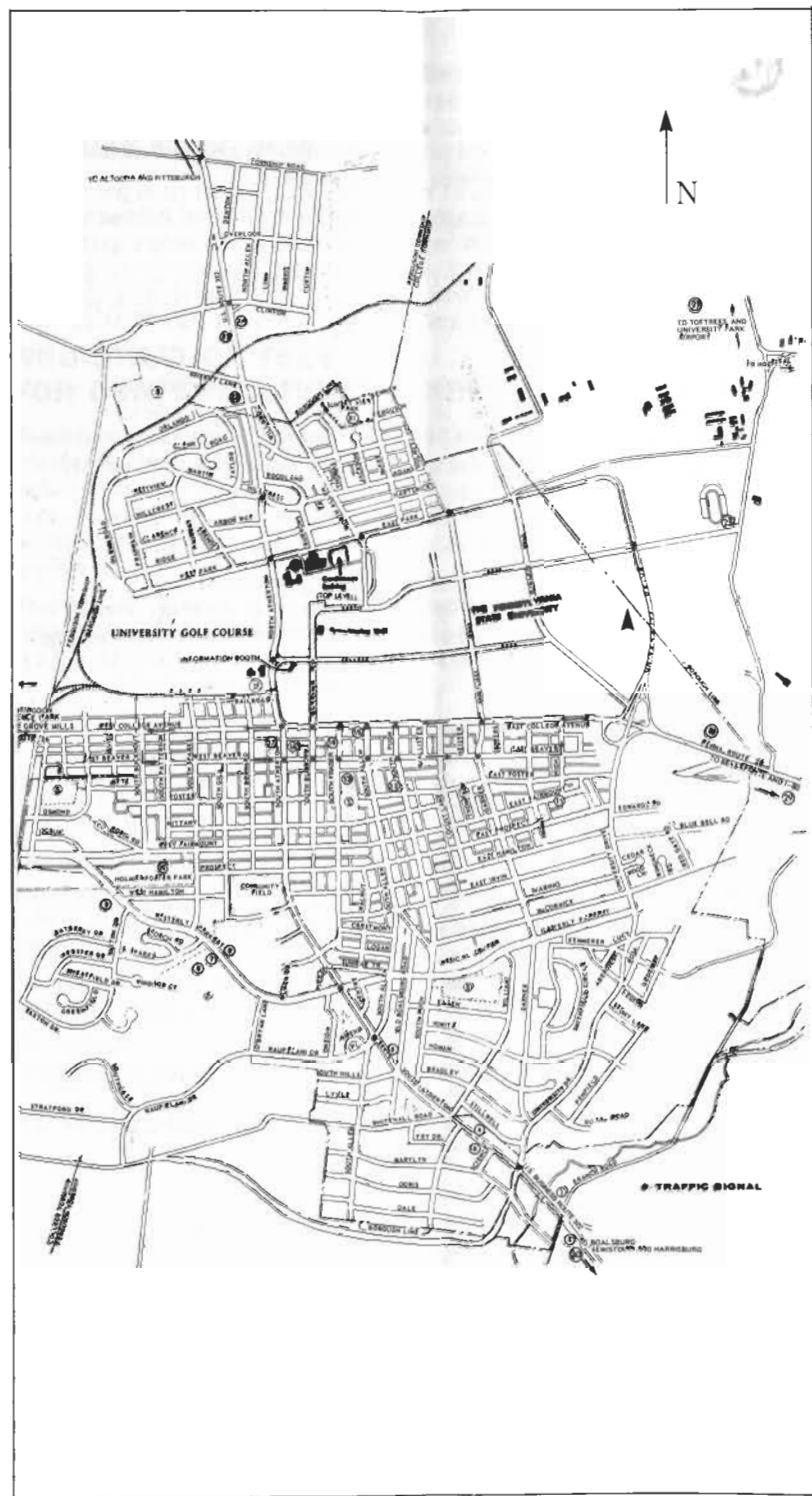
### CONFERENCE LOCATION AND TRANSPORTATION TO CONFERENCE (See Map)

The conference will be held in the Keller Conference Center on Penn State's University Park Campus with the exception of the Opening Ceremony which will occur at the nearby Nittany Lion Inn.

The campus is in State College Pennsylvania, near the geographical center of the state on Routes 26 and 322 and near I-80. US Air/US Air Express and United Express serve the University Park Airport, located five miles from campus. Limousine and taxi service (on call) are available for all flights.

### TRANSACTIONS

All registered NAMRC participants will receive one bound copy of the "Transactions of the North American Manufacturing Research Conference 1990" at conference registration. Additional copies may be purchased at the conference or by contacting William R. Sterner, 410 Keller Conference Center, Pennsylvania State University, University Park, PA 16802, telephone (814) 865-9173. The cost per copy is \$65 for NAMRI/SME and SME members and \$75 for nonmembers.



## CIRP INTERNATIONAL WORKING SEMINAR

CIRP, the International Institution for Production Engineering Research, presents the International Working Seminar on Artificial Intelligence Based Product Design. This working seminar will serve as a forum to review AI based design research activities and practice and will show directions for future research. This seminar features invited speakers.

The focus of this working seminar is on the aspects of Artificial Intelligence based design research with respect to product design. It will bring together eminent researchers in the field of design from various countries to integrate the ideas of design theory, design education, design for manufacturing and specialized AI techniques in design and Intelligent Computer Aided Design with respect to Product Design.

All the papers presented by the speakers are contained in the Working Seminar Proceedings. This one-day seminar features eight prominent researchers from different countries. The sessions will include formal presentations of the papers followed by discussions and will conclude with a panel discussion.

## SEMINAR LOCATION

The CIRP International Working Seminar will be held prior to the 18th NAMRC Conference, on May 22, 1990, at Penn State's University Park Campus. All CIRP sessions will be held in Room 215, the Hammond Building.

## PROCEEDINGS

All registered CIRP Seminar participants will receive one bound copy of the "Proceedings of the CIRP Working Seminar on Artificial Intelligence Based Product Design," at seminar registration. Additional copies may be ordered on site.

## LODGING

Blocks of rooms have been reserved for the nights of May 21-24 at two State College hotels and at residence halls on the Penn State campus. Conference attendees are urged to make their reservations early. To receive the special conference rates, please mention that you are attending the North American Manufacturing Research Conference. The rates listed do not include tax.

Lodging choices are:

	Rates	Cut-Off Dates
Atherton Hilton 125 S. Atherton Street (814) 231-2100	Single-\$55 and up Double-\$67 and up (plus tax)	April 23, 1990
Days Inn Penn State 240 S. Pugh St (814) 238-8454	Single-\$53 and up Double-\$63 and up (plus tax)	May 1, 1990
Residence Halls Penn State Campus (use registration form)	3 Night Package (May 22-24) Single-\$51, Double-\$36/person 4 Night Package (May 21-24) Single-\$69.50, Double-\$49.25/person (no tax charged on 3 and 4 Night Packages)	May 9, 1990

Bus service will be provided between the conference hotels and the Keller Conference Center.

## PARKING

Parking is available at both conference hotels. A limited number of parking spots are available on campus for \$2 per day on site.

## SPOUSE PROGRAM

An informal program is planned with visits to local museums, the Farmer's (Amish) Market, Penn's Cave, and other points of local interest. The \$40 registration includes transportation and fees. Meals are not included.

Fees for the Spouse Program are \$40. To register, complete the appropriate information on the registration form.

## REGISTRATION FEES FOR CONFERENCE AND SEMINAR

Registration fees for NAMRC XVIII are \$250 (U.S. currency) for advance registration and \$265 (U.S. currency) for on-site registration. This fee includes entrance to all sessions, a bound copy of the conference Transactions, refreshments, two lunches, and the conference banquet. There will be no one-day registration fees nor will there be any reduced fees for authors or session chairmen.

Students and retirees will be admitted to the conference for \$60 (U.S. currency) for advanced registration and \$75 (U.S. currency) on-site. This fee is a special rate to encourage attendance and includes entrance to all technical sessions, refreshments, and a bound copy of the conference Transactions. No meals are included.

Registration fees for "CIRP International Working Seminar on Artificial Intelligence Based Product Design" are \$80 (U.S. currency) for advance registration and \$100 (U.S. currency) for on-site registration. This fee includes entrance to all presentations, lunch on May 22nd, and one bound copy of the proceedings at seminar registration.

Extra lunch tickets will be available for \$12 each on May 23 and 24. Banquet tickets on May 23 are \$20 each. Please indicate which extra meal tickets you wish to purchase on the registration form.

Full refunds will be extended for cancellations received prior to May 9, 1990. After this date no refund will be extended.

For additional information, contact Professor Paul H. Cohen at (814) 863-2357 or William R. Sterner, Keller Conference Center at (814) 865-9173.

## TO REGISTER

Complete and return the registration form with the proper fee. Checks, money orders, or purchase orders should be made payable to The Pennsylvania State University. All payments must be in U.S. currency. Send registration and payment to: William R. Sterner, 410 Keller Conference Center, Pennsylvania State University, University Park, PA 16802.

## FURTHER INFORMATION

For additional conference information, please contact Professor Inyong Ham at (814) 863-2369 or Professor Paul H. Cohen at (814) 863-2357. For questions regarding registration, call William R. Sterner, Keller Conference Center at (814) 865-9173. During the conference, incoming messages for attendees will be accepted at (814) 865-9173 and will be posted on a bulletin board near the registration area.

**CIRP INTERNATIONAL WORKING SEMINAR**  
on Artificial Intelligence Based Product Design

**TUESDAY, MAY 22**

8:30 a.m.-8:50 a.m.

**REGISTRATION** 216 Hammond Building

8:50 a.m.-9:00 a.m.

**OPENING CEREMONY** 215 Hammond Building  
Prof. Inyong Ham, Penn State, U.S.A.

9:00 a.m.-9:45 a.m.

"Axiomatic Design of Products and Processes," Prof. Nam P. Suh, M.I.T., U.S.A.

9:45 a.m.-10:30 a.m.

"Design Philosophy and Intelligent Product Design," Prof. H. Yoshikawa,  
University of Tokyo, Japan

10:30 a.m.-10:45 a.m.

**COFFEE BREAK**

10:45 a.m.-11:30 a.m.

"A Review of AI Based Product Design," Prof. I. Ham and Prof. S. Kumara,  
Pennsylvania State University, U.S.A.

11:30 a.m.-12:15 p.m.

"Computer Aided Design and Part Databases," Prof. J. Peklenik, University of  
Ljubljana, Yugoslavia

12:15 p.m.-1:25 p.m.

**LUNCHEON** Atherton Hilton

1:30 p.m.-2:15 p.m.

"Education-Theory-Practice of Design," Prof. J. Peters, Catholic University of  
Leuven, Belgium

2:15 p.m.-3:00 p.m.

"Intelligent Computer Aided Design," Prof. S. Ohsuga, Research Center for  
Advanced Science and Technology, University of Tokyo, Japan

3:00 p.m.-3:15 p.m.

**COFFEE BREAK**

3:15 p.m.-4:00 p.m.

"Design Research—Trends and Future Directions," Prof. John R. Dixon,  
Department of Mechanical Engineering, University of Massachusetts, U.S.A.

4:00 p.m.-4:45 p.m.

"Conceptual Design and Automata Theory," Prof. V.R. Milacic, University of  
Beograd, Yugoslavia

4:45 p.m.-5:45 p.m.

**PANEL DISCUSSION**

**NAMRC XVIII**  
Technical Sessions and Program

**TUESDAY, MAY 22**

5:00 p.m.-7:00 p.m.

**REGISTRATION AND RECEPTION** Atherton Hilton

7:00 p.m.

NAMRI/SME Board of Directors Dinner, Atherton Hilton, Whitney Room

8:00 p.m.

NAMRI/SME Board of Directors Meeting, Atherton Hilton, Vanderbilt Room

**WEDNESDAY, MAY 23**

8:00 a.m.-9:00 a.m.

**REGISTRATION** Keller Conference Center

9:00 a.m.-9:30 a.m.

**OPENING CEREMONY** Nittany Lion Inn, Colonial Room

**OPENING REMARKS**

P.H. Cohen and I. Ham

**WELCOMING REMARKS**

W. Richardson, Executive Vice President and Provost, Pennsylvania State  
University

J.A. Brighton, Dean of Engineering, Pennsylvania State University

**INTRODUCTORY REMARKS**

K.J. Weinmann, NAMRI/SME President, Michigan Technological University

9:30 a.m.-10:00 a.m.

**KEYNOTE PAPER**

"The Historical Evolution of Computer-Integrated Manufacturing," M.E.  
Merchant, Director of Advanced Manufacturing Research, Metcut Research  
Associates

10:00 a.m.-10:30 a.m.

**COFFEE BREAK** Keller Conference Center, 5th Floor

10:30 a.m.-12:00 Noon

**SESSION F-1** 506 Keller

Co-Chairmen: S-I. Oh, Battelle Memorial Institute and J.C. Conway,  
Pennsylvania State University

F-1-1: "A Penalty Rigid-Plastic Finite Element Method for Determination of  
Stress Distributions at the Tool-Workpiece Interfaces in Metal Forming,"  
S.M. Hwang, M.S. Joun and J.B. Park, Pohang Institute of Science and  
Technology, Korea

F-1-2: "Finite Element Modeling of an Experimental Deep Drawing," S.H. Deite, C.J. VanTyne and D.K. Matlock, Colorado School of Mines

F-1-3: "Finite Element Analysis of Spread in Ring Rolling," Y.C. Shieu, Oklahoma State University

**10:30 a.m.-12:00 Noon**

**SESSION M-1** 501 Keller

Co-Chairmen: M.F. DeVries, University of Wisconsin and Y.C. Shin, Pennsylvania State University

M-1-1: "Acoustic Emission Feedback for Diamond Turning," J.R. Klaiber, D.A. Dornfeld and J.J. Liu, University of California-Berkeley

M-1-2: "Monitoring of Peripheral Milling Using Acoustic Emission," M. Liu, Oklahoma State University, S.Y. Liang, Georgia Institute of Technology

M-1-3: "Multiple Sensor Integration via Neural Networks for Estimating Surface Roughness and Bore Tolerance in Circular End Milling," A.C. Okafor, M. Marous, and R. Tipirani, University of Missouri-Rolla

**10:30 a.m.-12:00 Noon**

**SESSION S-1** 502 Keller

Co-Chairmen: R.E. DeVor, University of Illinois at Urbana-Champaign and P. Egbelu, Pennsylvania State University

S-1-1: "Implications of Robotic Assembly for Power Train Components," A. Jawaid, University of Warwick, England, K. Gill, Dover Group, England

S-1-2: "Determine/Optimize an Industrial Robot's Process Capability Using Taguchi Methods," B.C. Jiang, J.C.L. Chang, J.T. Black, and L. Kutz, Auburn University

S-1-3: "Obstacle Avoidance for Redundant Robots," K.M. Carr, K.A. Erickson, and P.M. Ferreira, University of Illinois at Urbana-Champaign

**12:00 Noon-1:30 p.m.**

**LUNCHEON** Nittany Lion Inn, Assembly Room

**1:30 p.m.-3:00 p.m.**

**SESSION F-2** 506 Keller

Co-Chairmen: A. Male, Westinghouse Electric Corporation and R. Shivpuri, Ohio State University

F-2-4: "A Research on Integrally Hydrobulging Spherical Vessels," Z.R. Wang, S. Zhang, J. Dong, T. Wang, and S. Yuan, Harbin Institute of Technology, China and S. Li, Drexel University

F-2-5: "The Alcoa Reformed Shell Forming Process," S.C. Biondich and R.E. Dick, Alcoa Laboratories

F-2-6: "Rapid Tooling and Prototyping by Three Dimensional Printing," E. Sachs, M. Cims, P. Williams, and D. Brancazio, Massachusetts Institute of Technology

**1:30 p.m.-3:00 p.m.**

**SESSION M-2** 501 Keller

Co-Chairmen: R. Komanduri, Oklahoma State University and T.C. Ramaraj, Tennessee Technological University

M-2-4: "An Analytic Cutting Force Model for Milling," G. Yucesan and A.E. Bayoumi, Washington State University, L.A. Kendall, Michigan Technological University

M-2-5: "Analytical Predictions of Rotary Cutting Processes," C.H. Choi and D.A. Dornfeld, University of California-Berkeley

M-2-6: "A New Approach to Estimating the Cutting Process Damping under Working Conditions," S.C. Lin, National Tsing-Hwa University, ROC, R.E. DeVor and S.G. Kapoor, University of Illinois at Urbana-Champaign, and J.W. Sutherland, PDC, Inc.

**1:30 p.m.-3:00 p.m.**

**SESSION S-2** 502 Keller

Co-Chairmen: S.C-Y. Lu, University of Illinois at Urbana-Champaign and S. Kumara, Pennsylvania State University

S-2-4: "Ultrasonic Part Recognition System Incorporated in a Microcomputer Controlled Robotic Cell," Z. Katz and D. DeM. Villet, University of Natal, South Africa

S-2-5: "A Robot Vision System for 3-D Metrology," T-Q. Kim, M.C. Leu, and F.Y. Shih, New Jersey Institute of Technology

S-2-6: "Dynamic Analysis and Modeling of a High Speed Spindle System," Y.C. Shin, K.W. Wang and C.H. Chen, Pennsylvania State University

**3:00 p.m.-3:30 p.m.**

**COFFEE BREAK**

**3:30 p.m.-5:00 p.m.**

**SESSION F-3** 506 Keller

Co-Chairmen: R.A. Kohser, University of Missouri-Rolla and C. Ruud, Pennsylvania State University

F-3-7: "The Significance of the Elastic Deformation of the Workpiece Sample in the Strip-Tension Friction Test," S.R. Shonsle and K.J. Weinmann, Michigan Technological University

F-3-8: "A New Approach to the Evaluation of High Strain Flow Curve Data Using the Torsion Test," M. Knorr, Ohio State University, A. Greber and K. Pohlandt, University of Stuttgart, West Germany

F-3-9: "An Investigation of the Heat Transfer and Friction in Hot Forging of 304 Stainless and Ti-6Al-4V," P.R. Burte, Delco Moraine Division of General Motors, S.L. Semiatin, Battelle Memorial Institute and T. Altan, Ohio State University

**3:30 p.m.-5:00 p.m.**

**SESSION M-3** 501 Keller

Co-Chairmen: D. Dornfeld, University of California-Berkeley and K. Ehmann, Northwestern University

M-3-7: "Computer Animation of Chip Flow and Chip Curl in an Expert Process Planning System for Metal Machining," Y. Yao, D. Jamieson and X.D. Fang, University of Wollongang, Australia, I.S. Jawahir, Carboloy, Inc.

M-3-8: "Shear Angle Model for Control Contact Machining of Aluminum and Brass," P.C-H Liu and J T. Black, Auburn University

M-3-9: "Material Removal Mechanism in Creep Feed Grinding of Alumina with Resinoid, Vitrified and Electroplated Diamond Wheels," T.W. Liao and G. Sathyanarayanan, Lehigh University

**3:30 p.m.-5:00 p.m.**

**SESSION S-3** 502 Keller

Co-Chairmen: G. Chrissolouris, Massachusetts Institute of Technology and D.J. Medeiros, Pennsylvania State University

S-3-7: "Elimination of Adjustment on Machining," D.S. Cochran, Ford Motor Company

S-3-8: "A New Control Method and System for FMS Job Scheduling," M. Zhou and Z. Hen, Tsinghua University, China

S-3-9: "In-Process 100% Measurement and Statistical Analysis for an Automotive Body Assembly Process," S. Hu and S.M. Wu, University of Michigan

**6:00 p.m.-7:00 p.m.**

**COCKTAIL RECEPTION** (Cash Bar) Days Inn Penn State

**7:00 p.m.-9:00 p.m.**

**CONFERENCE BANQUET** Days Inn Penn State

## THURSDAY, MAY 24

**8:30 a.m.-10:00 a.m.**

**SESSION F-4** 506 Keller

Co-Chairmen: K.J. Weinmann, Michigan Technological University, and D. Pennebacker, Ford-New Holland

F-4-10: "Study on the Ratios of the Axial Forces in Rotary Forging Flanges with a Shaft," X. Pei, Y. Xiu and B. Xiao, Harbin Institute of Technology, China, and X. Zhenrui, Benxi Commission of Foreign Economic Relations and Trade, China

F-4-11: "Deformation-Induced Residual Stresses and Stress Corrosion in Deep-Drawn Components of Brass Materials," K. Lange and L. Bruckner, University of Stuttgart, West Germany

F-4-12: "Blocker Forging Preform Design by Solid Modelling Primitive Modification," Y. Zhang and W.A. Knight, University of Rhode Island

**8:30 a.m.-10:00 a.m.**

**SESSION M-4** 501 Keller

Co-Chairmen: W. DeVries, Rensselaer Polytechnic Institute and R. Lindeke, Cleveland State University

M-4-10: "A Non-Contact Sensing Technique for Measuring the Gripping Forces in Lathe Chucks," K. Nyamekye and M. Srinivas, Auburn University

M-4-11: "Neural Network Approach for Representation and Simulation of 3D-Cutting Dynamics," I. Tanael, Tufts University

M-4-12: "Effect of Scratching Fluids on Surface Integrity of Ceramics," D. Zhang, Shanghai Jiao Tong University, China

**8:30 a.m.-10:00 a.m.**

**SESSION S-4** 502 Keller

Co-Chairmen: M.C. Leu, New Jersey Institute of Technology and S. Joshi, Pennsylvania State University

S-4-10: "A Prototype of a 'Next-Generation-Control' Environment," P.K. Wright, I. Greenfeld and C. Mayes, New York University

S-4-11: "Simulation Study of an Improved Scheme for Forecasting Compensatory Control (FCC)," H.Q. Zhang, Southwestern Jiao Tong University, China, J. Ni and S.M. Wu, University of Michigan

S-4-12: "Development of a Hybrid Table System (Rolling Guideway with Variable Frictional Force)," T. Aoyama and I. Inasaki, Keio University, Japan

**10:00 a.m.-10:30 a.m.**

**COFFEE BREAK**

**10:30 a.m.-12:00 Noon**

**SESSION F-5** 506 Keller

Chairman: T. Altan, Ohio State University

Panel Discussion on "Near Net Shape Forming"

Panel Members: A. Male, Westinghouse Electric Corporation

S-I. Oh, Battelle Memorial Institute

S.M. Sabrott, Eaton Corporation

K.J. Weinmann, Michigan Technological University

**10:30 a.m.-12:00 Noon**

**SESSION M-5** 501 Keller

Chairman: J. Mayer, Jr., Texas A & M University

Panel Discussion on "Machining of Ceramics"

Panel Members: G. Chrissolouris, MIT

M. Hashish, Flow Research, Inc.

S. Malkin, University of Massachusetts

K. Subramanian, Norton Co.

**10:30 a.m.-12:00 Noon**

**SESSION S-5** 502 Keller

Chairman: J. Mason, Xerox Corporation

Panel Discussion on "Concurrent Design"

Panel Members: R. Nagle, Cognition Corporation

G. Shumaker, WROC/MTR, WPAFB

D. Whitney, Charles Stark Draper Lab

C.C. Wilson, University of Tennessee

12:00 Noon-1:30 p.m.

**NAMRI/SME LUNCHEON** Nittany Lion Inn, Colonial Room

1:30 p.m.-3:30 p.m.

**SESSION F-6** 506 Keller

Co-Chairmen: G.D. Lahoti, Timken Co. and A. Bayoumi, Washington State University

F-6-13: "Prediction of 'Flow Lines' by Forging Process Modeling,"  
H. Delgado, Wyman-Gordon Co.

F-6-14: "Mathematical Simulation of Complex Asymmetrical Rolling of Clad Sheets and Sandwich Sheets," M. Xiuchi and Y-M. Hyang, University of Tokyo, Japan

F-6-15: "Combining Finite Element Methods and the Cockcroft and Latham Criteria to Predict Free Surface Workability of Cold Forgings," J.L. Frater and G.J. Petrus, Cleveland State University

F-6-16: "Development of a Computer Controlled Multi-action Press for Physical Modeling of Complex Deformation," J.A. Pale and R. Shivpuri, Ohio State University

1:30 p.m.-3:30 p.m.

**SESSION M-6** 501 Keller

Co-Chairmen: S. Malkin, University of Massachusetts and R. Goddard, American Sterilizer Co.

M-6-13: "High Speed Drilling of 390 Aluminum," J. Alverio, J.B. Agapiou and C-H. Shen, General Motors Technical Center

M-6-14: "Observations of the Effect of Diamond-Like Carbon Coating on Alumina Tool Flank Wear," S. Kim, W.J. Varhue and D. Durham, University of Vermont

M-6-15: "Practical Implementation of Tertiary Cutter Motions for the Improvement of 3-D Sculptured Surface Characteristics in Milling," M-S. Hong and M.F. Ehmman, Northwestern University

M-6-16: "Improving Cutting Performance by Using Boring Bar with Torsionally Compliant Head," E. Rivin and H. Kang, Wayne State University

1:30 p.m.-3:30 p.m.

**SESSION S-6** 502 Keller

Co-Chairmen: D. Koenig, Steinway and B. Wang, SUNY Buffalo

S-6-13: "Computer Aided Planning for Flexible Assembly," C. Han and A.K. Hazouz, Florida Atlantic University

S-6-14: "Just-in-Time Process Planning as Part of a Decentralized Shop Floor Controlling System," G. Warnecke, P. Mertens, C. Schulz and H. Biebinger, University of Kaiserslautern, West Germany

S-6-15: "The Enhanced Hitachi Assembleability Evaluation Method (AEM)," S. Miyakava, Y. Ohashi, and M. Iwata, Hitachi Ltd., Japan

S-6-16: "Research and Development on Synthetic Cutting Tool Monitoring with AE Signal," L. Zheng, Z.B. Lou, K.W. Tong, J.Q. Xu, and S.P. Zhang, Tsinghua University, China

3:30 p.m.-4:00 p.m.

**COFFEE BREAK**

4:00 p.m.-5:00 p.m.

**TOUR OF MANUFACTURING LABORATORIES**

A tour of the Department of Industrial and Management Systems Engineering including Computer-Integrated Manufacturing/FMS Laboratory, Electronics Assembly Laboratory, Computer-Aided Design Laboratory, Precision Measurements Laboratory, and Artificial Intelligence/Design Laboratory. Tours of Pennsylvania State's Materials Research Laboratory and Applied Research Laboratory may also be arranged.

5:00 p.m.-6:00 p.m.

**WINE AND CHEESE RECEPTION** Nittany Lion Inn, Fireside Lounge

6:00 p.m.

**NAMRI/SME MEMBERSHIP MEETING** 501 Keller

7:00 p.m.

**ASME PRODUCTION ENGINEERING DIVISION MEETING** 501 Keller

(Please note that this meeting will start immediately following the NAMRI/SME Membership Meeting.)

**DINNER ON YOUR OWN**

**FRIDAY, MAY 25**

8:30 a.m.-10:00 a.m.

**SESSION F-7** 506 Keller

Chairman: L. Anand, National Science Foundation

"Recent Developments and Trends in Forming Research and Technology"

This session will feature informal presentations on recent progress and future trends in forming research and technology. Interested participants from academia and industry are encouraged to present their research and ideas. Please contact Professor P.H. Cohen (814) 863-2357 if you are interested in participating.

8:30 a.m.-10:00 a.m.

**SESSION M-7** 501 Keller

Co-Chairmen: L. Kops, McGill University and C. Goss, MANTECH

M-7-17: "Experimental Study of Die-Sinking by Electroerosion-Dissolution Machining," A.B.E. Khairy, Sultan Qaboos University, Sultanate of Oman

M-7-18: "Improvement in EDM Tool Wear Ratio and Material Removal Rate with Modified R.F. Control Unit," W.M. Wang and K.P. Rajurkar, University of Nebraska-Lincoln

M-7-19: "Aspects of Surface Quality for Laser Machining of Composite Materials," G. Chrissoulouris and P. Sheng, Massachusetts Institute of Technology



8:30 a.m.-10:00 a.m.

**SESSION S-7** 502 Keller

Co-Chairmen: R. Weill, Technion, Israel and A. Lehtihet, Pennsylvania State University

S-7-17: "Tolerance Primitives for Composition and Synthesis," R.G. Wilhelm and S. C-Y. Lu, University of Illinois at Urbana-Champaign

S-7-18: "Selection of Dimensions, Tolerances and Precision for Automated Assembly of Pegs and Holes," C. Doydum and N. Duke Perreira, Lehigh University

S-7-19: "Analysis of Manufacturing Cells Tended by Single Servers," M. Lulu, University of Alabama-Monteville and J T. Black, Auburn University

S-7-20: "Analysis of Optimal Machining Conditions for Flow-Type Automated Manufacturing Systems Under Maximum Production Rate," K. Hitomi, Kyoto University, Japan

10:00 a.m.-11:00 a.m.

**COFFEE BREAK**

**ADJOURNMENT**

# ADVANCE REGISTRATION FORM

**NAMRC XVIII**  
May 22-25, 1990

**CIRP International Working Seminar**  
on Artificial Intelligence Based Product Design  
May 22, 1990

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