

CONFERENCE TIME TABLE

MONDAY, MAY 20	(Wisconsin Center)
Registration	8:00 a.m. (Lobby)
Welcome	9:00 a.m. (Lakeshore Room)
Morning Break	10:00 a.m.
Sessions	10:30 a.m.
Lunch	12:00 Noon (Wisconsin Center)
Sessions	1:30 p.m.
Afternoon Break	3:00 p.m.
Sessions	3:30 p.m.
Reception	6:30 - 7:30 p.m. (Alumni Lounge)
Banquet	7:30 - 9:30 p.m. (Wisconsin Center)
TUESDAY, MAY 21	(Wisconsin Center)
Registration	8:00 a.m. (Lobby)
Sessions	8:30 a.m.
Morning Break	10:00 a.m.
Lunch	12:00 Noon (Wisconsin Center)
Sessions	1:30 p.m.
Afternoon Break	3:00 p.m.
Sessions	3:30 p.m.
Tour of Laboratories	5:30 - 7:30 p.m. (Engineering Campus)
Reception	7:30 - 8:30 p.m. (Lowell Hall)
Dinner	8:30 - 9:30 p.m. (Lowell Hall)
WEDNESDAY, MAY 22	(Wisconsin Center)
Registration	8:00 a.m. (Lobby)
Sessions	8:30 a.m.
Morning Break	10:00 a.m.
Sessions	10:30 a.m.
Program Concludes	12:00 Noon

PROCEEDINGS

A copy of the PROCEEDINGS will be given to each full paid registrant attending the Conference. Additional copies may be purchased at the time of registration for \$30.00. After May 23, 1974, the PROCEEDINGS will be available from SME's Publication Sales Department 20501 Ford Road, Dearborn, MI 48128 at a cost of \$35.00.

UNIVERSITY OF WISCONSIN - MADISON
SITE OF THE ...
SECOND NORTH AMERICAN
METALWORKING RESEARCH
CONFERENCE
MAY 20-22, 1974 MADISON, WISCONSIN



With the participation of the following:

NAMRC-II Second North American Metalworking Research Conference
 1513 University Avenue
 Madison, WI 53706

Scientific, Engineering and
 Research Personnel
 in the Field of
 Metalworking
 Please take note:
 An International Conference
 on Metalworking

REGISTRATION TIME & LOCATION

MONDAY, MAY 20, 1974
8:00 a.m., The Wisconsin Center
TUESDAY, MAY 21, 1974
8:00 a.m., The Wisconsin Center
WEDNESDAY, MAY 22, 1974
8:00 a.m., The Wisconsin Center

ADVANCED REGISTRATION

Registration by mail before May 6 is recommended to avoid congestion at the time of the Conference and to assure the possibility of attendance and accommodations.

Please give a complete mailing address on the registration card. The registration fee is \$120.00. A check in this amount payable to Second North American Metalworking Research Conference should accompany the registration card.

REGISTRATION ON ARRIVAL

The registration desk will be open during the sessions. The desk will be located at the entrance of The Wisconsin Center on the first floor. There will also be a registration desk on Sunday evening in the Lobby of The Wisconsin Center. If you do not register in advance by mail, you are urged to bring the completed registration card when you register on arrival.

LOCATION

All sessions will be held in The Wisconsin Center building, Lake and Langdon streets, Madison. There is no parking space at this location. A visitors' parking lot is located on North Murray Street near State Street (with ten-hour meters). Visitors' parking is also available at street level of the Helen C. White Hall, 600 N. Park Street (across from the Memorial Union), with entrance on Park Street (with ten-hour meters). A public parking ramp (Lake Street Ramp) is located on N. Lake Street near State Street. Also, persons coming in automobiles may park their cars in University Lot No. 60, located west of the campus on Walnut Street (for fifty cents per day). Campus buses travel the mile from Lot No. 60 to the Memorial Union (within a block of The Wisconsin Center) at frequent intervals. The bus fare is fifteen cents.

TRANSPORTATION

Madison is served by the following: Northwest, Ozark, and North Central Airlines; Greyhound and Badger Bus lines; and Amtrak (via chartered bus from the railroad station in Columbus, Wisconsin). Direct service as well as many connections via Minneapolis, Chicago and/or Milwaukee are available. Specific schedules should be verified in the traveler's own locality.

REGISTRATION FEES

Participant	Ladies	
Full Conference	\$120.	\$40.
Monday only or Tuesday only	80.	20.
Wednesday only	50.	

The fees include participation at sessions, breaks, lunches, evening meals and one copy or the NAMRC-11 PROCEEDINGS. Additional copies of the NAMRC-11 PROCEEDINGS will be available at the Conference at \$30.00 per copy. The fees do not include accommodations, breakfasts, or lunch on Wednesday.

RESERVATIONS will be accepted on a "first come, first served" basis. Your registration should be received no later than two weeks prior to the Conference. Registrations after the two week deadline should be made by telephone or wire. Your registration should be confirmed prior to attending the program. To insure attendance, early registration is advised. Space may be reserved by individuals required to obtain employer authorization. Companies may place reservations and send names at a later date.

TAX DEDUCTION OF EXPENSES: *An income tax deduction is allowed for expenses of education (including registration fees, travel, meals, lodging) undertaken to maintain and improve professional skills (see Treas. Reg. 1.162-5).*

LADIES PROGRAM

This program is being planned to provide an attractive opportunity for visiting ladies to see as much as possible of Madison, its University, and the surrounding area. The program is being organized for the Monday and Tuesday of the conference. The ladies will be free on Wednesday morning to do as they wish. The program may be improvised to some extent, depending on the number of participants. There is likely to be a visit to a nearby community which will involve booking a charter bus and hence we will appreciate your indicating on the attached form if your wife will be coming with you.

SPONSOR

UNIVERSITY OF WISCONSIN-MADISON

COLLEGE OF ENGINEERING



NAMRC-11 is being hosted by the College of Engineering, The University of Wisconsin-Madison with the participation of The American Society of Mechanical Engineers, Production Engineering Division, The Canadian Society for Mechanical Engineering, Production Division, and the Society of Manufacturing Engineers.



CONFERENCE PROSPECTUS

The Second North American Metalworking Conference (NAMRC-11) has as its purpose and scope the presentation and discussion of the results of basic and applied metalworking research. The format of the conference is similar to the highly successful NAMR Conference held last May at McMaster University.

The papers presented at this conference represent both original monographic works as well as summary reports on larger projects, which combine high scientific standards with a large relevance to metalworking technology. The papers are contained in the Conference PROCEEDINGS, and have been accepted from speakers from North America and Europe representing many of the renowned and established metalworking research centers.

CONFERENCE ORGANIZATION

The North American Metalworking Conferences have been created by a group in North America dedicated to the furthering of knowledge, its dissemination and application in the field of production and manufacturing processes.

Invitations for and screening of papers for the Conferences is the responsibility of the Scientific Committee of the North American Metalworking Research Group. All of the technical arrangements for this Conference were carried out by the NAMRC-11 Organizing Committee.

SCIENTIFIC COMMITTEE

- J. Bollinger, University of Wisconsin-Madison
- L. Colwell, University of Michigan
- N. Cook, Massachusetts Institute of Technology
- D. French, Waterloo University
- S. Kobayashi, University of California-Berkeley
- I. LeMay, University of Saskatchewan
- W. Rice, CHAIRMAN, Queen's University
- J. Schey, University of Illinois-Chicago Circle
- M. Shaw, Carnegie-Mellon University
- J. Tustvy, McMaster University
- B. von Turkovich, University of Vermont
- S. Wu, University of Wisconsin-Madison

ORGANIZING COMMITTEE

- T. Altan, Battelle Columbus Laboratories For the American Society of Mechanical Engineers, Production Engineering Division
- J. Watson, WABCO Limited
- J. Wacker, Tool & Manufacturing Co. For the Society of Manufacturing Engineers
- J. Bollinger, University of Wisconsin-Madison
- M. DeVries, CHAIRMAN, University of Wisconsin-Madison
- D. Ermer, University of Wisconsin-Madison
- S. Wu, University of Wisconsin-Madison

SECOND NORTH AMERICAN METALWORKING RESEARCH CONFERENCE

UNIVERSITY OF WISCONSIN - MADISON

MONDAY, MAY 20, 1974

8:00 a.m. Registration, Lobby, The Wisconsin Center

SESSION 1 9:00 a.m. Lakeshore Room

Welcome — Introduction — Opening Remarks
Marvin F. DeVries, *Chairman*, Organizing Committee,
NAMRC-II;

W. Robert Marshall, *Dean*, College of Engineering, University of Wisconsin-Madison;
William B. Rice, *Chairman*, Scientific Committee, NAMRC-II and Head, Mechanical Engineering Department, Queen's University, Kingston, Ontario.

SESSION 2 10:30 a.m. Lakeshore Room

CO-CHAIRMEN
Norman F. Snyder, General Motors Institute, Flint, Michigan;
Michael Davis, Sundstrand Machine Tool, Belvidere, Illinois.

AUTHORS
"A New Approach to Manufacturing Systems", S.M. Wu, S. M. Pandit, University of Wisconsin-Madison, Madison, Wisconsin;

"Dynamic Analysis and Evaluation of Design Improvements of a Grinding Spindle", Otto Suselk, The Timken Co., North Canton, Ohio;

"On the Reduction of Noise in Circular Sawing", M. F. DeVries, S. M. Wu, University of Wisconsin-Madison, Madison, Wisconsin.

SESSION 3 10:30 a.m. Room 109

CO-CHAIRMEN
Dell K. Allen, Brigham Young University, Provo, Utah;
Orville Ehrhardt, Giddings and Lewis Machine Tool Co., Fond du Lac, Wisconsin.

AUTHORS
"The Optimal Formulation of Production Group Flowlines", Warren L. Dedlich, Proctor and Gamble Co., Cincinnati, Ohio;

Allan Soyster, Temple University, Philadelphia, Pennsylvania;
Inyong Ham, Pennsylvania State University, University Park, Pennsylvania;

"Random Sequencing of Machine Unloading by Industrial Robots", Geoffrey Boothroyd, University of Massachusetts, Amherst, Massachusetts;

Kazuhito Morishita, Hitachi Ltd., Yokohama, Japan;

A. G. Atkins, University of Michigan, Ann Arbor, Michigan.

SESSION 4 10:30 a.m. Auditorium

CO-CHAIRMEN
Botros M. Botros, North Carolina A & T State University, Greensboro, North Carolina;
Francis W. Bouliger, Battelle Columbus Laboratories, Columbus, Ohio.

AUTHORS
"Forging Analysis — A New Approach", R. P. McDermott, A. N. Bramley, University of Leeds, Leeds, England;

"Material Utilization: Name of the Game in Hot Forging", S. C. Jain, Norman G. Orrell, Wyman-Gordon Co., Worcester, Massachusetts;

"On the Interaction of Solidification With Metal Shaping Processes", G. S. Cole, Ford Motor Co., Dearborn, Michigan.

George S. Reichenbach, Norton Co., Worcester, Massachusetts.

AUTHORS
"A Theoretical Study of Laser-Induced Thermal Fatigue of Carbide Tool Materials", Daniel R. Deotto, K. K. Wang, Cornell University, Ithaca, New York;

"The Effect of Thermoelectric Current on Tool Wear", C. H. Kahng, G. L. Veigelahn, Michigan Technological University, Houghton, Michigan;

SESSION 6 7:30 p.m. Auditorium

CO-CHAIRMEN
Walter L. Dahl, Rock Island Arsenal, Rock Island, Illinois;

R. G. Fenton, University of Toronto, Toronto, Ontario.

AUTHORS
"Approximation of Composite Material Strength", Betzalel Avitzur, Lehigh University, Bethlehem, Pennsylvania;

"Forging Complex Shapes from Fiber-Reinforced Metal-Matrix Composites", H. A. Kuhn, T. Er Turk, A. Lawley, Drexel University, Philadelphia, Pennsylvania;

"A Simplified Minimum Internal Energy of Deformation Postulate and Its Application to Metalforming Processes", Lawrence Berkowitz, Howard A. Kuhn, Drexel University, Philadelphia, Pennsylvania.

SESSION 7 3:30 p.m. Lakeshore Room

CO-CHAIRMEN
Stuart J. Deusch, Georgia Institute of Technology, Atlanta, Georgia;

Joseph R. Roubik, Kearney and Trecker Corp., Milwaukee, Wisconsin.

AUTHORS
"Variability of Tool Life as a Function of Its Mean Value", Moshe Y. Friedman, Norman Zlatin, Mercut Research Associates, Cincinnati, Ohio;

"A Statistical Analysis of Accelerated Versus Conventional Methods of Tool Life Testing", James L. Thomas, University of Nebraska, Lincoln, Nebraska;

Brian K. Lambert, Texas Tech University, Lubbock, Texas; "Experimental Investigation of Life of Circular Saws — Part I — Effect of Speed and Feed Using Statistical Methods", Vijay A. Tipnis, John D. Christopher, Moshe Y. Friedman, Mercut Research Associates, Cincinnati, Ohio.

SESSION 8 3:30 p.m. Auditorium

CO-CHAIRMEN
Nathan H. Cook, Massachusetts Institute of Technology, Cambridge, Massachusetts;

Steven Swetman, Huskey Injection Molding Systems, Ltd., Toronto, Ontario.

AUTHORS
"Deformation Mechanics During Adiabatic Shear", B. F. von Turkovich, University of Vermont, Burlington, Vermont;

"On the Dislocation Mechanics of the Metal Cutting Process", J. T. Black, University of Rhode Island, Kingston, Rhode Island;

B. Lengyel, Imperial College of Science and Technology, London, England.

SESSION 13 1:30 p.m. Lakeshore Room

CO-CHAIRMEN
Lester V. Colwell, University of Michigan, Ann Arbor, Michigan;

Clyde A. Sulhan, Master Chemical Corporation, Perrysburg, Ohio.

AUTHORS
"An Investigation of the Dynamic Cutting Force Coefficient", J. Tlustý, B. S. Goel, McMaster University, Hamilton, Ontario;

"Machine Tool Chatter: Effect of Equivalent Surface Slope on Shear Angle During Wave Generating and Regenerative Chatter", J. F. Sarnicola, State University of New York at Binghamton, Binghamton, New York;

G. Boothroyd, University of Massachusetts, Amherst, Massachusetts;

"Consideration and Representation of Errors in the Three Dimensional Working Area of Machine Tools", R. Schuttschik, Eidgenössische Technische Hochschule, Zurich, Switzerland.

SESSION 14 1:30 p.m. Auditorium

CO-CHAIRMEN
J. J. Waller, Canadair, Ltd., Montreal, Quebec;

T. L. Subramanian, Battelle Columbus Laboratories, Columbus, Ohio.

AUTHORS
"The Formation of Central Bursts During Cold Extrusion", Joseph Pepe, Watervliet Arsenal, Watervliet, New York;

"Hydrostatic Extrusion of Electrical Conductors", Robert Lugosi, Westinghouse Electric Corporation, Pittsburgh, Pennsylvania;

"Some Studies on Force Requirements and Flow Behavior of Simultaneous Forward and Backward Extrusion of Cans", Rolf Geiger, University of Stuttgart, Stuttgart, W. Germany.

SESSION 15 3:30 p.m. Lakeshore Room

CO-CHAIRMEN
Richard E. Devor, University of Illinois, Urbana, Illinois;

Arthur R. Dishrow, General Motors Technical Center, Warren, Michigan.

AUTHORS
"A Computer Program for Optimization of Cutting Conditions for Turning and Milling", D. French, G. Quinn, University of Waterloo, Waterloo, Ontario;

"Maximization of the Production Rate with Constraints by Linear Programming and Sensitivity Analysis", D. S. Ermer, University of Wisconsin-Madison, Madison, Wisconsin;

D. C. Patel, Miller Compressing Co., Milwaukee, Wisconsin; "Application of Computer Simulation Method for Optimizing Production Machining Operations", J. E. Mayer, Jr., D. J. Stauffer, S. S. Cowell, Ford Motor Co., Dearborn, Michigan.

SESSION 16 3:30 p.m. Auditorium

CO-CHAIRMEN
Brian K. Lambert, Texas Tech University, Lubbock, Texas;

E. W. Mielnik, University of Iowa, Iowa City, Iowa.

Arrive: May _____ a.m. _____ p.m. _____
 Depart: May _____ (Time) _____ a.m. _____ p.m. _____
 I wish to share a twin room with _____
 I wish to make reservations at _____
 City and State _____
 Address _____
 Name _____
 Number in party _____
 The above motels/hotels are within one to four blocks of the Wisconsin Center. Reservations can be made on the attached form. If your first choice hotel is not available, a reservation will be made for you at one of the other hotels. Reservations will be honored on a first-come first-served basis and are not guaranteed unless submitted before May 6, 1974. Therefore, please fill in the following and return it at your earliest convenience. Note the motels/hotels marked with an * do charge an additional state and local tax of 10%.

Housing facilities near the Wisconsin Center are available. Room reservations can be made with approximate rates as follows:

Wisconsin Center Guest House (1 block)	Single \$13
Connecting shared baths	Twin \$16
Town Campus Motel* (1 block)	Double \$19
Howard Johnson* (3-1/2 blocks)	Single \$16
	Double \$22

IS YOUR WIFE ATTENDING? Yes No
 (name of hotel) _____

HOUSING INFORMATION

SESSION 9 8:30 a.m. Lakeshore Room

CO-CHAIRMEN
K. G. Adams, University of Waterloo, Waterloo, Ontario; Gary J. Kimmert, Gleason Works, Rochester, New York.

AUTHORS
"Practical Design of Externally Flanged Bolted Joints on Machine Structures", B. C. Cuppan, Giddings and Lewis Machine Tool Co., Fond du Lac, Wisconsin;
"Computer-Aided Design of Hydraulic Systems", G. Suta, H. Eitel, University of Stuttgart, Stuttgart, W. Germany;
"Evaluation of Non-Metallic Way Bearings for Machine Tool Applications", S. M. Marathe, Giddings and Lewis Machine Tool Co., Fond du Lac, Wisconsin.

SESSION 10 8:30 a.m. Auditorium

CO-CHAIRMEN
Ernest J. Duwell, Minnesota Mining & Manufacturing Co., St. Paul, Minnesota; Iain Lamlay, University of Saskatchewan, Saskatoon, Saskatchewan.

AUTHORS
"Prediction of Temperature Distributions in Tube Extrusion Using a Velocity Field Without Discontinuities", C. D. Lahoti, T. Altan, Battelle Columbus Laboratories, Columbus, Ohio;
"Analysis of Axisymmetric Flow Through Curved Dies Using a Generalized Upper Bound Approach", Vijay Nagpal, Ervin E. Underwood, Georgia Institute of Technology, Atlanta, Georgia;
"The Use of the Fiber Structure of High-Purity Aluminum for the Study of Metal Flow in Plastic Deformation", M. W. Hopson, K. J. Weinmann, A. A. Hendrickson, Michigan Technological University, Houghton, Michigan;
 G. W. Rowe, University of Birmingham, Birmingham, England.

SESSION 17 8:30 a.m. Lakeshore Room

CO-CHAIRMEN
Richard O. Lane, Frank Bancroft Co., Dearborn, Michigan; Milton C. Shaw, Carnegie-Mellon University, Pittsburgh, Pennsylvania.

AUTHORS
"The Mechanics of Abrasive Conditioning", James N. Brackert, Carnegie-Mellon University, Pittsburgh, Pennsylvania;
"Wear Flats Generated During Grinding With Various Grinding Fluids", M. E. Forrester, S. Malkin, University of Texas, Austin, Texas;
"Characteristics of Precision Production Grinding With Borazon (CBN) Wheels", R. P. Lindsay, Cincinnati Milliron-Heald Division, Worcester, Massachusetts.

SESSION 18 8:30 a.m. Auditorium

CO-CHAIRMEN
T. C. Greenhough, Frederick Parker, Ltd., Scarborough, Ontario; Orville D. Lascoe, Purdue University, W. Lafayette, Indiana.

AUTHORS
"Development of the Plane-Strain Compression Test", A. H. Lonn, Caterpillar Tractor Co., Peoria, Illinois;
 J. A. Sehey, University of Illinois-Chicago Circle, Chicago, Illinois;
"Plane Strain Sheet and Tube Extrusion Through Cosine-Shaped Dies With Friction", B. I. Bachrach, S. K. Samanta, Ford Motor Co., Dearborn, Michigan;
"A Finite Element Analysis of the Plane Strain Drawing Problem", J. L. Gordon, Westinghouse Electric Corp., Pittsburgh, Pennsylvania;
 A. S. Weinstein, Carnegie-Mellon University, Pittsburgh, Pennsylvania.

SESSION 11 10:30 a.m. Lakeshore Room

SESSION 19 10:30 a.m. Lakeshore Room

Mail at least ten (10) days prior to the Conference. After the 10 day limit please call 608/262-1122.
MAIL TO:
 Registration Department
 The Wisconsin Center, 702 Langdon Street
 Madison, Wisconsin 53706
 Please register the following for the Second North American Metalworking Research Conference
 May 20-22, 1974
 University of Wisconsin-Madison
 (Please print or type)

NAME (First) (Initial) (Last)	POSITION (Last) (Initial)
NAME (First) (Initial) (Last)	POSITION (Last) (Initial)
COMPANY (First) (Initial) (Last)	PHONE (Area Code)
ADDRESS	CITY AND STATE
ZIP CODE	

Please enclose check or company P.O. with registrations. Make cheques payable to:
 Second North American Metalworking Research Conference

CO-CHAIRMEN
Amrit L. Goel, Syracuse University, Syracuse, New York; Ulrich Rembold, Whippool Corp., Benton Harbor, Michigan.

AUTHORS
"Spectral Analysis of Modulation Phenomena for Determining Physical Behavior", J. G. Bollinger, D. L. Ewald, University of Wisconsin-Madison, Madison, Wisconsin;
"From Adaptive Control Constraint to a Pilot System for Optimization", G. Suta, H. Eitel, University of Stuttgart, Stuttgart, W. Germany;
"A Constrained Search Adaptive Controller for Metal Cutting", B. R. Beadle, Giddings and Lewis Machine Tool Co., Fond du Lac, Wisconsin;
 J. G. Bollinger, University of Wisconsin-Madison, Madison, Wisconsin.

CO-CHAIRMEN
John C. Cherra, McGill University, Montreal, Quebec; Michael Field, Mercut Research Associates, Cincinnati, Ohio.

AUTHORS
"Scanning Electron Microscopy and Auger Electron Spectroscopy Observations on the Role of Lead in the Machining of Steel", Robert W. Thompson, Dennis T. Quinto, Bernard S. Levy, Inland Steel Co., East Chicago, Indiana;
"Grinding Wheel Surfaces", G. H. Pette, B. H. Anderson, Norton Co., Worcester, Massachusetts;
"Scanning Electron Microscopy and Microprobe Wear Studies of Single Crystal Aluminum-Oxide Vitrified Grinding Wheels During Dry Grinding of S.A.E. 4150 Steel", J. A. Kirk, University of Maryland, College Park, Maryland;
 W. D. Synluta, Scientific Energy Systems Corp., Watertown, Massachusetts.

SESSION 12 10:30 a.m. Auditorium

SESSION 20 10:30 a.m. Auditorium

CO-CHAIRMEN
Jayash G. Dalal, Inland Steel Co., East Chicago, Indiana; Carl F. Zorowski, North Carolina State University, Raleigh, North Carolina.

AUTHORS
"Flat-Tool Forging", G. D. Lahoti, Battelle Columbus Laboratories, Columbus, Ohio;
 Shiro Kobayashi, University of California, Berkeley, Berkeley, California;
"Temperature Rise in the High Speed Compression of Right Cylindrical Billets", M. Mohitpour, Arya-Mehr University of Technology, Tehran, Iran;
 B. Lengyel, Imperial College of Science and Technology, London, England;
"Temperature Distribution in the Radial Upsetting of a Flat Disc", Arno Blass, University of Santa Catarina, Florianopolis, Brazil;

CO-CHAIRMEN
Serope Kalpakjian, Illinois Institute of Technology, Chicago, Illinois; Robert A. Powell, Indal Canada, Ltd., Weston, Ontario.

AUTHORS
"An Analysis of Exisymmetric Sheet Metal Forming", J. C. Garteau, Michigan Technological University, Houghton, Michigan;
"A Criterion for Plastic Instability in Punch Stretching of Thin Sheets", A. K. Ghosh, General Motors Technical Center, Warren, Michigan;
 S. S. Heckler, Los Alamos Scientific Labs, Los Alamos, New Mexico;
"The Significance of Tensile Necking Retardation on Sheet Metal Formability", J. C. Benedyk, Brunswick Corp., Skokie, Illinois.