

Kornel F. Ehmann, Ph.D.

James N. and Nancy J. Farley Professor in Manufacturing and Entrepreneurship

**Northwestern University
Department of Mechanical Engineering
Evanston, Illinois 60208-3111
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EDUCATION:

March	1970	B.S.	University of Belgrade, Yugoslavia Mechanical Engineering
June	1974	M.S.	University of Belgrade, Yugoslavia Mechanical Engineering
December	1979	Ph.D.	University of Wisconsin-Madison Mechanical Engineering <i>Thesis:</i> "Machine Tool System Identification and Forecasting Control of Chatter," S.M. Wu Advisor

POSITIONS HELD:

2006 -	Adjunct Chair Professor Chung Yuan Christian University Chung-Li, Taiwan
2004 -	Adjunct Professor Department of Mechanical and Industrial Engineering University of Illinois at Urbana/Champaign
2004 -	Distinguished Honorary Professor Department of Mechanical Engineering Indian Institute of Technology (IIT), Kanpur, India
1990 -	Professor Department of Mechanical Engineering Northwestern University, Evanston, Illinois
1985 - 1990	Associate Professor Department of Mechanical Engineering Northwestern University, Evanston, Illinois
1981 - 1985	Assistant Professor Department of Mechanical Engineering University of Wisconsin-Madison, Madison, Wisconsin
1980 - 1981	Research Associate Department of Mechanical Engineering University of Wisconsin-Madison, Madison, Wisconsin

1977 - 1979 Research Assistant
Department of Mechanical Engineering
University of Wisconsin-Madison, Madison, Wisconsin

1970 - 1976 Assistant Lecturer
Department of Mechanical Engineering
University of Belgrade, Yugoslavia

ACADEMIC EXPERIENCE AND SERVICE:**A. TEACHING:****Courses Developed:**University of Wisconsin-Madison:

1980	ME 601	Computer Aided Manufacturing
1981	ME 729	Stochastic Approach to Machine Tool Dynamics and Control
1982	ME 601	Robotics
1983	ME 439	Introduction to Robotics
1983	ME 739	Advanced Automation and Robotics
1984	ME 903	Stochastic Analysis of Machining Accuracy

Northwestern University

1986	ME C40-2	Computer Integrated Manufacturing - CAD/CAM
1987	ME D39	Computer Control in Manufacturing
1988	ME D43	Theory of Metal Cutting
1990	ME B40	Introduction to Design and Manufacturing
1996	ME C40-3	Computer Integrated Manufacturing - Manufacturing Automation
2001	ME 395	Mechanical Systems Design (w/ Henry Stoll)
2006	ME 395	Micromanufacturing (w/ Jian Cao)

Courses Taught:University of Wisconsin-Madison:

ME 310	Manufacturing Processes
ME 410	Advanced Manufacturing Processes
ME 428	Numerical Control

Northwestern University

ME B01	Mechanics I
ME B02	Mechanics II
CE B12	Mechanics
ME C40	Introduction to Manufacturing Processes
ME C15	Theory of Machines - Machine Design
ME C91	Fundamentals of Control Systems
ME D95	Computer Control in Manufacturing
ME 240	Introduction to Mechanical Design & Manufacturing
ME 340	Computer Integrated Manufacturing - 1 Manufacturing Processes - 2 CAD/CAM - 3 Manufacturing Automation
ME 395	Mechanical Systems Design
ME 443	Metal Cutting
ME 495	Micromanufacturing

B. RESEARCH:**Areas of Interest:**

Micro/meso-scale manufacturing; CAM--Computer Aided Manufacturing; Robotics; Machine Tool Dynamics and Control; Metal Cutting Operations; Adaptive Control; Precision Engineering; Engineered Surfaces;

Students Supervised Who Have Received Degrees:**M.S. Students**

1. Z. Djordjevic, **An Experimental Study on the Grinding of Twist Drill Flutes** (1982).
2. J. C. Su, **Static Analysis of Turbine Blade** (1982).
3. T. Z. Jou, **On-Line Computer Evaluation of Surface Topography** (1982).
4. H. Kasat, **On-Line Tool Life Performance Monitoring of a Single Point Cutting Tool** (1983)
5. R. A. Schwartz, **Casting Temperature Control in an Automated Die Cast Work Cell with Considerations Toward Improving Robot Performance** (1984).
6. F. Keshmiri, **Development of an End-Effector for Riveting** (1984).
7. B. T. Wu, **Volumetric Analysis as Applied to Robotic Systems** (1985).
8. R. Recker, **Feasibility Study of Pitch Error Compensation in Precision Screw Cutting** (1985).
9. J. J. Kotowski, **Kinematic Error Analysis of Robotic Manipulators** (1986).
10. S. J. Lym, **A Study of Novel Laundry Technology Concepts** (1987).
11. R. K. Kim, **Optimal Cutting Conditions in Turning Operations** (1987).
12. G. Mathew, **Design and Analysis of a Micropositioning Device** (1988).
13. C. Y. Yeh, **Error Simulation for a Multi-axis Machine** (1988).
14. M. Stanley, **The Improvement of Milled Surface Characteristics Using Tertiary Motions of the Milling Cutter** (1988).
15. T. Perzentka, **Digitization of Three Dimensional Surfaces Using a Laser** (1989).
16. D. Q. Feng, **Design of a Tool Actuator for a Piezoelectric Crystal Actuated Piston Machining System** (1989).
17. H.M.S. Wang, **Vibration Control in a High-speed Gantry Type CNC Machine** (1989).
18. M. S. Hong, **Practical Implementation of Tertiary Cutter Motions for the Improvement of 3-D Sculptured Surface Characteristics in Milling** (1989).
19. A. Iqbal, **Dynamic Analysis of a Twist Drill Using Finite Element Techniques** (1990).
20. D. F. Chang, **Predicting Important Variables in Face Milling Operations**, (1990).
21. A. M. Ignatonis, **Development of an Automatic Roller Positioning System for Newspaper Presses** (1990).
22. A. Artola, **Design of a Manually Controlled Drill Point Grinder**, (1991).
23. J.-Y. Wang, **A Program for Position and Angular Measurements by a Laser Interferometer**, (1992).
24. H.-Y. Chyan, **Feasibility of Eigenstructure Assignment for the Control of a Linear Feed Drive**, (1992).
25. S.-M. Wang, **Volumetric Error Compensation for Multi-Axis Machines**, (1992).
26. Weishen Chen, **Performance Analysis of Micro-Hole Drilling**, (1994).
27. Sheng-Hung Wang, **Whirling Vibration in Drilling During Initial Penetration**, (1994).

28. Tsung-Chen Lu, **A Numerical Simulation Model for the Face Milling Operation**, (1994).
29. James Patrick Bohan, Jr., **Proposal for an Automatic Control System Generator for Manufacturing Machines Based on Modular, Open Architecture Technologies**, (1994).
30. Yi-Cheng Chang, **The Application of Fractal Geometry in Surface Characterization**, (1994).
31. Chien-Ming Chen, **A Multiple-Degree-of-freedom Error Motion Measurement System**, (1994).
32. Chicheng J. Wang, **Surface Topography Control in Single Point Cutting**, (1994).
33. Sriram V. Karipneni, **Analysis of Tool-changing Systems and Redesign of an Existing Unit**, 1995.
34. Parameswaran Iyer, **Experimental Analysis of Skidding and Wandering Motion during Initial Penetration of the Drill**, (1996).
35. Kekin V. Seth, **A CNC Helical Micro-Drill Point Grinder**, (1996).
36. Steven Johnson, **A Study into Replicating Chatter on Laboratory Mill Stands utilizing Experimental Modal Analysis**, (1998).
37. Sachin Ganglani, **Design and Implementation of a Helical Drill Point Grinder**, (2001).
38. Ramesh Subrahmanian, **Development of a Meso-Scale Machine Tool (mMT) for Micro-Machining**, (2002).
39. Ismael Rodriguez, **Stability and Chatter in Rolling with a Non-Uniform Roll Radius**, (2003).
40. Adrish Majumdar, **An Investigation of the Effect of Process Parameters on the Meso-Scale Orthogonal Turning of Brass**, (2005).
41. Erick Haro, **An Experimental Investigation of the Orthogonal Micro-Turning of Cartridge Brass**, (2005).
42. Kellan P. O'Connor, **Design of a Part Clamping Device for a Miniature Machine Tool**, (2006).
43. Milos Coric, **Automatic Wig Manufacturing System** (2006).

Ph.D. Students

1. K. J. Kim, **Mechanical Structure Modal Analysis by Dynamic Data System (DDS) Methodology** (1982) (with S. M. Wu)
2. T. Y. Ahn, **Dynamic Cutting Process Identification by Dynamic Data System Models** (1982) (with S. M. Wu)
3. K. H. Kim, **Forecasting Compensatory Control of Roundness in Cylindrical Grinding** (1982) (with S. M. Wu).
4. E. J. Moon, **Forecasting Compensatory Control of Machining Straightness** (1984) (with S. M. Wu).
5. Y. C. Shin, **Dynamic Analysis of the Machine Tool System** (1984) (with S. M. Wu).
6. S. H. Lee, **Trajectory Control in the World Coordinate System by an Adaptive Forecasting Algorithm** (1985) (with S. M. Wu).
7. T. R. Kim, **Dynamic Analysis of Tool-Holder Systems** (1985) (with S. M. Wu).

8. S. J. Lee, **The Influence of Drill Characteristics and Entry Mechanisms on Drilling Performance** (1985) (with S. M. Wu).
9. K. Kim, **Forecasting Compensatory Control of Cylindricity in Contour Boring Operations** (1985) (with S. M. Wu).
10. I. N. Tansel, **Three Dimensional Cutting Dynamics** (1986) (with S. M. Wu).
11. C. W. Park, **Forecasting Compensatory Control of Machining Flatness** (1986) (with S. M. Wu).
12. D. W. Cho, **A New Multi-Input Modal Analysis and Three Dimensional Cutting Dynamics Identification Method Applied to Milling Operations** (1986) (with S. M. Wu).
13. S. D. Fassois, **Fast Algorithms for ARMA Parameter Estimation** (1986).
14. J. T. Huang, **On-line Self Turning Adaptive Control for Industrial Robots** (1987).
15. A. S. C. Bose, **Adaptive Trajectory Planning for Industrial Robots** (1987).
16. K. H. Kim, **Milling Dynamics in a Closed-Loop System** (1987).
17. J. Cesarone, **Manipulator Collision Avoidance by Dynamic Programming** (1987).
18. S. Le, **Active Vibration Suppression for Robotic Manipulators** (1988).
19. B. Bahrololoumi, **Design of an Optical Sensor System for Adaptive Control of a Seam Tracking Robot** (1988).
20. S. J. You, **Synthesis and Generation of Milled and Polished Surfaces** (1989).
21. P. D. Lin, **Error Analysis, Measurement and Compensation of Multi-Axis Machines** (1989).
22. D. T. Parthimos, **Nonlinear Behavior of the Dynamic Cutting Process**, (1990).
23. J. H. Heo, **Eigensensitivity Synthesis and its Applications to Structural Dynamics Modification**, (1991).
24. M. N. Jalisi, **Microdrilling Mechanics and Performance**, (1991).
25. W. T. Kwon, **Tool Wear Analysis and Monitoring**, (1992).
26. S. J. Lym, **Development of a Modular Open Architecture Controller for Error Reduction in Manufacturing Machines**, (1992).
27. S. K. Kang, **Micro-Drill Geometry and Grinding**, (1993).
28. M. S. Hong, **Generation, Characterization and Synthesis of Engineering Surfaces**, (1994).
29. I. S. Yun, **Chatter in Rolling**, (1995).
30. S. M. Wang, **Volumetric Error Compensation for Multi-Axis Machines**, (1996).
31. C. H. Chiou, **A Computational Model for End Milling Operations**, (1997).
32. Heng-Chwan Chyan, **Curved Helical Drill Technology For Micro-Hole Drilling**, (1997).
33. A. J. Patel, **Error Analysis and Accuracy Enhancement of a Hexapod Machine**, (1998).
34. P. H. Hu, **Stability and Chatter in Rolling**, (1998).
35. K.Y. Kim, **Prediction and Characterization of the Machined Surface Topography in the Frequency Domain**, (2000).
36. H. Zhao, **Geometry and Mechanics of Spade Drilling Operations**, (2000).
37. Y. Gong, **Modeling and Simulation of Micro-drilling Dynamics**, (8/2001).
38. R. Sokol, **Entropic Control: Introducing Disorder to Elude Chatter**, (12/2003).
39. H. Sung, **High-Speed Fluid Bearing Micro-Spindles for Meso-scale Machine Tools (mMTs)**, (2/2007).

Post-doctorates and Visiting Scholars Supervised:

1. Zhen-Lie Zhang, Instructor, Jilin University, Changchun, PRC (1982-1984).
2. Jayaraman Raja, Postdoctoral Fellow, India (1984-1985).
3. Radovan Kovacevic, Associate Professor, University of Titograd, Yugoslavia (1984-1985).
4. Alexander Yanchevsky, Associate Professor, Leningrad Electrical Engineering Institute, USSR (1985).
5. Lubos Gasparik, Assistant Professor, University of Zilina, Czechoslovakia (1986).
6. Cheng Lin, Professor, Hunan University, Changsha, PRC (1990-1991)
7. Zhen-Lie Zhang, Instructor, Jilin University, Changchun, PRC (1993-1994).
8. Mohamed Emad Seddik Soliman, Assistant Lecturer, Assiut University, Egypt, (1993-
9. Michal Wieczorowski, Instructor, Politechnika Poznanska, Poznan, Poland (1994-1995).
10. In Suk Yun, Northwestern University, Evanston, IL (1995-1996).
11. Tae-Yong Kim, Post Doctoral Research Fellow, Seoul National University, Seoul, Korea. (1996-1997).
12. A.C. Lee, Professor, National Chiao Tung University, Hsinchu, Taiwan (1996-1997).
13. Min-Sung Hong, Ajou University, Suwon, S. Korea (2000-2001).
14. Han Ul Lee, Pohang Institute of Science and Technology (POSTECH) (2005)
15. Seung Kook Ro, Korea Institute of Materials and Machinery (KIMM) (2005)
16. Dae-Bong Choi, Korea Institute of Materials and Machinery (KIMM) (2006)

Current Graduate Student Supervision:

- | | |
|------------------------|---------------|
| 1. Kostyantyn Malukhin | Ph.D. Student |
| 2. Hyung Suk Yoon | Ph.D. Student |
| 3. Xaver Neumeyer | PhD. Student |
| 4. Huyue Zhao | PhD. Student |

C. COMMITTEE SERVICE:**Departmental Committees:**University of Wisconsin-Madison:

- 1984 - 1985 Capital Equipment Committee
 1982 - 1985 Chairman, Production Engineering Division Graduate Committee
 1983 - 1984 Design Content Committee
 1981 - 1983 Undergraduate Affairs Committee

Northwestern University:

- 1989 Curriculum Committee
 1989 Renovation Committee
 1990 Awards Committee
 1991 Graduate Curriculum Committee
 1993 Benchmarking Committee

1992 - 1993 Faculty Search Committee (Chair)
 1993 - 1994 Faculty Search Committee (Member)
 1994 - 1995 5-Year Planning Committee (Chair)
 1995 - 1996 Undergraduate Curriculum Revision Committee
 1997 - 2000 Machine Shop Committee
 1998 - ME Department Executive Committee
 1998 Awards Committee
 2000 - Space Allocation/Distribution Committee
 2000 - Graduate Curriculum Committee

College Committees:

University of Wisconsin-Madison:

1982 - 1985 Chairman, Ad Hoc Committee Wisconsin Center for Advanced Automation and Robotics

Northwestern University:

1985 - 1989 Executive Committee of the Center for Manufacturing Engineering
 1987 - 1990 Tech Relations with Industry Committee
 1991 - 1992 Selection Committee for Assistant Dean & Director of CPD
 1992 - 1994 Tenure and Promotion Committee
 1992 - 1994 Acting Director, Center for Manufacturing Engineering
 1993 - 1994 Committee on the Future
 1994- Undergraduate Manufacturing Engineering Advisory Committee
 1995 McCormick Manufacturing Institute Committee
 1999 ABET - Intra-School Site Visit Team for Materials Science Department
 1999 - 2001 Tenure and Promotion Committee

Outside Committees:

1987 - 1988 SME Transactions Editorial Subcommittee
 1988 - 1990 Program Committee of the 1990 Japan-USA SFA
 1988 - NAMRC Scientific Committee
 1990 - 1991 MI'92 Organizing Committee
 1990 - 1995 Executive Committee Production Engineering Division of ASME, (Division Chair, 1994 -1995).
 1993 - 1994 NAMRC XXII Co-Chair, Organizing Committee (with W.R.D. Wilson)
 1993 - 1994 First S.M. Wu Symposium on Manufacturing Science, Organizing Committee
 1994 - 1995 Division Representative on the Manufacturing Technical Group Operating Board of ASME
 1994 - 1995 Production Engineering Division of ASME, Nominating Committee, (Chair)
 1994 - 1995 M. Eugene Merchant Manufacturing Medal of ASME/SME Board of Award, (Member)
 1994 - 1996 International Program Committee Member - International Manufacturing Engineering Conference (IMEC) August 7-9, 1996, Storrs, Connecticut.

- 1994 - 1995 International Program Committee Member - The First World Congress on Intelligent Manufacturing, Mayaguez, Puerto Rico, February 1995.
- 1995 - 2001 Associate Technical Editor Trans. ASME, Journal of Engineering for Industry (12/94-12/00).
- 1995 - S. M. Wu Memorial Lecturer Selection Committee, University of Michigan, Ann- Arbor.
- 1996 - 1997 ASME: Manufacturing Technical Group Operating Board - Member at large.
- 1996 - 1997 International Program Committee Member - The Second World Congress on Intelligent Manufacturing, Budapest, Hungary, June 1997.
- 1997 - 1998 International Program Committee, The 4th International Seminar "Intelligent Manufacturing Systems - Theory and Practice", Belgrade Yugoslavia.
- 1997 - 1998 Program Committee for the 1998 Japan-USA Symposium on Flexible Automation.
- 1997 - International Editorial Board, Int. J. of Production Engineering and Computers.
- 1997 - 1999 ASME: Manufacturing Engineering Division, Technical Committee on Machine Tools (Chair)
- 1999 International Scientific Committee of the WSES International Conference on Mathematics and Computers in Mechanical Engineering, Florida Keys - Marathon, Florida, July 25-29, 1999.
- 1999 - 2006 NAMRI/SME Board of Directors (NAMRI/SME President 2005)
- 2000 International Organizing Committee, Mechatronics, The 7th Mechatronics Forum International Conference, 6th - 8th September 2000, Atlanta, GA.
- 2000 - 2003 ASME Manufacturing Engineering Division, Blackall & Ennor Awards Committee
- 2001 - Associate Technical Editor; SME, Journal of Manufacturing Processes
- 2002 - Technical Editor; ASME Journal of Manufacturing Science & Engineering
- 2003 - Reviewing Committee – Int. J. Machine Tools and Manufacture
- 2004 - 2005 Board of Directors, President, NAMRI/SME
- 2004 - 2005 Panel Chair for the WTEC study on "Miniaturization of Manufacturing Technologies: The Microfactory-of-the-future"
- 2004 - Editorial Board – International Journal of Precision Engineering and Manufacturing
- 2004 Co-organizer – US-Korea Workshop on Micromanufacturing, IMTS/Northwestern, 9th – 10th September 2004
- 2005 Workshop Leader – WTEC Workshop on Micromanufacturing, 21st – 22nd April 2005, Arlington, VA
- 2005 Organizer and Moderator – Panel on Micro Manufacturing – a WTEC Study, Thirty-third North American Manufacturing Research Conference, 24th-27th May 2005, New York, NY
- 2004 - Board Member, Global Technology Advisory Board, AMT-The Association for Manufacturing Technology, 2004-2005
- 2004 - Advisor SME-Micromanufacturing Conference
- 2006 International Advisory Committee – Int. Forum on Systems and Mechatronics, 6th – 8th December 2006, Tainan, Taiwan.
- 2006 - WTEC/NSF Panel on Advanced Manufacturing, Chair
- 2006 - Advisory Board: Journal of Mechanics, Materials and Processing - The Japan Society of Mechanical Engineers

D. CONTINUING EDUCATION ACTIVITIES:

- 1984 - 1985 University of Wisconsin Extension (UWEX), Short Course, **Flexible Automation and Robotics** (with Professor B. Ravani)
- 1987 Northwestern University, Continuing Engrg. Education - Executive Briefings, **Effective Use of Robots in Manufacturing**
- 1988 - 1989 Northwestern University, Continuing Engrg. Education, CES-8943, **Design for Production**, (Course for Zenith Electronics)
- 1988 - 1993 Northwestern University, Tech. Corporate Partners Tech Consultant for Navistar and General Motors.
- 1992 - 1993 Northwestern University, Continuing Engrg. Education, **Design for Manufacture**, (Short Course; Team Member)

PROFESSIONAL ACTIVITIES:**A. PROFESSIONAL AND HONORARY SOCIETIES:**

- ASME: Fellow
 SME: Fellow
 NAMRI: Senior Member
 Sigma-Xi: Member

B. REVIEWER - PANELIST FOR:**Agencies:**

1. National Science Foundation
2. Natural Sciences and Engineering Research Council of CANADA
3. Hong-Kong Science Foundation
4. Australian Research Council, Australia
5. King Fahd University of Petroleum & Minerals, Saudi Arabia
6. Board of the Austrian Science Fund, Austria
7. Indiana 21st Century Research and Technology Fund – Indiana Economic Development Corporation
8. VINNOVA (The Swedish Governmental Agency for Innovation Systems)

Journals:

9. ASME Transactions, Journal of Manufacturing Science and Engineering, formerly Journal of Engineering for Industry
10. ASME Transactions, Journal of Dynamics Systems, Measurements and Control
11. ASME Transactions, Journal of Mechanisms, Transmissions and Automation in Design
12. ASME Transactions, Journal of Tribology
13. Proceedings of the Institution of Mechanical Engineers Part K: Journal of Multi-body Dynamics
14. SME Journal of Manufacturing Systems
15. SME Journal of Manufacturing Processes
16. Robotics and Computer Integrated Manufacturing
17. Engineering with Computers

18. Precision Engineering, Journal of the American Society for Precision Engineering
19. Journal of Sound and Vibration
20. International Journal of Machine Tools and Manufacture
21. International Journal of Structural Stability and Dynamics
22. IEEE Transactions on Systems, Man, and Cybernetics
23. IEEE Transactions on Control Systems Technology
24. IEEE Transactions on Robotics and Automation
25. European Journal of Control
26. Experimental Heat Transfer
27. Mechanism and Machine Theory
28. Mechanics of Structures and Machines – International Journal of
29. U.S. Civilian Research & Development Foundation (CRDF)
30. Proc. Inst. Mech. Eng., Part C: J. of Mechanical Engineering Science
31. International Journal of Robotics Research
32. Journal of Experimental Heat Transfer
33. Journal of Robotic Systems
34. Proc. Inst. Mech. Eng., Part N: J. of Nanoengineering and Nanosystems
35. Journal of Materials Processing Technology
36. Meccanica, International Journal of the Italian Association of Theoretical and Applied Mechanics AIMATA
37. Proc. Inst. Mech. Eng., Part B: J. of Engineering Manufacture

C. CONSULTING:

Alcoa, Davenport, Iowa; IBM, Endicott, New York; Johnson Wax, Racine, Wisconsin; Ford, Detroit, Michigan; Naval Research Laboratory, Washington, DC; Poly-Hi, Fort Wayne, Indiana; General Motors, Warren, Michigan; General Electric, Burlington, Vermont Ekstrom & Carlson, Rockford, Illinois; General Dynamics, Fort Worth, Texas; The Ingersoll Milling Machine Company, Rockford, Illinois; Tulon, Co., Gardena, California; Chrysler Co., Toledo, Ohio; Du Page Die Casting and Fabricating Co., Niles, Illinois; SpeedFam, Chandler., AZ, Lawrence Livermore National Laboratory, CA; American Tool Companies, Inc.,

PUBLICATIONS:

(Earlier publications appear under the name: *Kornel F. Eman*)

A. BOOKS:

1. **Trajectories**, invited article for the "Encyclopedia of Robotics," R. C. Dorf and S. Y. Nof, eds., John Wiley, 3, 1796-1810, (with S. H. Lee and J. Cesarone) (1988).
2. **Engineered Surfaces**, ASME: PED-Vol. 62, Edited by K. F. Ehmann and W. R. D. Wilson Proceedings of the Symposium on Engineered Surfaces at the ASME Winter Annual Meeting, (1992).
3. **Manufacturing Science and Engineering**, ASME: PED-Vol. 64, Edited by K. F. Ehmann, (Proceedings of five Symposia at the ASME Winter Annual Meeting), New Orleans, Nov. 28 – Dec.3, (1993).
4. **WTEC Panel Report on: International Assessment of Research and Development in Micromanufacturing**, K.F. Ehmann Panel Chair, (with D. Bourell, M. Culpepper, T. Hodgson, T. Kurfess, M. Madou, K. Rajurkar, R. DeVor), (2006) (Currently in print by Springer)

B. PATENTS:

1. "Spade-type Drill Bit Having Helical Configuration," I. Singh, K.F. Ehmann, No. 7140814, November 2006

C. PAPERS:

1980.

1. "A Feasibility Study of On-Line Identification of Chatter in Turning Operations," **Transactions of ASME: Journal of Engrg. for Industry**, **102**(4), 315-321 (with S. M. Wu) (1980).
2. "Forecasting Control of Machining Chatter," **ASME: Computer Appl. in Mfg. Systems**, W. R. DeVries, ed., PED - 2, 37-52 (with S. M. Wu) (1980).
3. "A Comparative Study of Classical Techniques and the Dynamic Data System (DDS) Approach for Machine Tool Structure Identification," **Proc. 8th Annual North American Manufacturing Research Conference**, Rolla, MO, 401-404 (with S. M. Wu) (1980).

1981.

4. "Analysis of Cutting Process Damping," **Proc. 9th Annual North American Manufacturing Research Conference**, University Park, PA, 247-249 (with S. M. Wu and P. Balakrishnan) (1981).
5. "Cutting Process Identification from Closed-Loop Operating Data," **Proc. 9th Annual North American Manufacturing Research Conference**, University Park, PA, 528-531 (with S. M. Wu and R. C. Gan) (1981).

1982.

6. "Modal Analysis of Mechanical Structures by Time Series Approach," **Proc. 10th Annual North American Manufacturing Research Conference**, McMaster Univ., Hamilton, Canada, 417-421 (with K. J. Kim and S. M. Wu) (1982).
7. "Development of a New Milling Cutter for Aluminum Honeycomb," **Intl. Journal of Machine Tool Design and Research**, **23**(2/3), 81-91 (with S. M. Wu and M. Mendoza) (1982).
8. "Feasibility of Single Pass Boring Operations," **Intl. Journal of Machine Tool Design and Research**, **23**(1), 53-59 (with H. Sun and S. M. Wu) (1982).
9. "Microcomputer Controlled 7-Axis Drill Point Grinder," **Proc. of 14th Natl. SAMPE Tech. Conf.**, 14, 444-455 (with J. Hawkins and S. M. Wu), October (1982).

1983.

10. "Upgrading Performance of Grinding Machines," **Proc. 21st Annual Abrasive Engrg. Soc. Conf./Exhibit**, Itasca, IL, 133-139 (with S. M. Wu), April (1983).
11. "Modal Analysis of Machine Tool Structures Based on Experimental Data," **Transactions of ASME: Journal of Engrg. for Industry**, **105**(5), 282-287 (with K. J. Kim) (1983).
12. "Chatter Suppression in Turning," **Proc. 11th Annual North American Manufacturing Research Conference**, Madison, WI, 399-402 (with S. Y. Tsai and S. M. Wu) (1983).
13. "Forecasting Compensatory Control of Spindle Error Motion in Cylindrical Grinding," **ASME: Statistics in Mfg.**, S. G. Kapoor and M. R. Martinez, eds., **PED**, **9**, 75-81 (with K. H. Kim and S. M. Wu) (1983).
14. "CAM-Another Viewpoint," **Proc. 24th Machine Tool Design and Research Conference**, Manchester, England, (with S. M. Wu) (1983).
15. "Simulation Study of Forecasting Compensatory Control of Machining Straightness," **ASME: Control of Mfg. Processes & Robotic Systems**, D. E. Hardt, W. J. Book, eds., Boston, MA, 47-53 (with E. Moon and S. M. Wu) (1983).

1984.

16. "An Extended FFT Algorithm for ARMA Spectral Estimation," **IEEE Transactions on Acoustic Speech & Signal Processing**, **32**(1), 168-170 (with R. C. Gan and S. M. Wu) (1984).
17. "Identification and Control of Chatter in Turning," **Proc. Computer-Based Factory Automation, 11th Conference on Production Research and Technology**, Pittsburgh, PA, 413-417 (1984).
18. "Identification of Natural Frequencies and Damping Ratios of Machine Tool Structures by DDS," **Intl. Journal of Machine Tool Design and Research**, **24**(3), 161-169 (with K. J. Kim and S. M. Wu) (1984).
19. "Experimental Complex Modal Analysis of Machine Tool Structures," **Computer Integrated Manufacturing and Robotics**, M. C. Leu, M. R. Martinez, eds., New Orleans, LA, 243-258, (1984); also in **Transactions of ASME: Journal of Engrg. for Industry**, **111**(2), 116-124, (with Y. C. Shin and S. M. Wu) (1989).
20. "Implementation of Forecasting Compensatory Control for Machining Straightness," **Computer Integrated Manufacturing and Robotics**, M. C. Leu, M. R. Martinez, eds., New Orleans, LA, 231-241; (with E. Moon and S. M. Wu) (1984).
21. "On the Relationship Between Thermal EMF and Vibration in Turning," **Proc. 12th Annual North American Manufacturing Research Conference**, Houghton, MI, 359-362 (with Z. L. Zhang) (1984).

22. "Identification of Complex Mode Shapes of Machine Tool Structures by the Dynamic Data System Method," **Proc. 12th Annual North American Manufacturing Research Conference**, Houghton, MI, 331-335 (with Y. C. Shin and S. M. Wu) (1984).

1985.

23. "Identification of the Transfer Function of the Dynamic Cutting Processes--A Comparative Assessment," **Intl. Journal of Machine Tool Design and Research**, **25**(1), 75-90, (with T. Y. Ahn and S. M. Wu) (1985).
24. "Identification of Engineering Systems with the Recursive Multichannel Maximum Entropy Method," **12th Conference on Production Research and Technology**, Madison, WI, 57-61 (1985).
25. "Analysis of Three-Dimensional Cutting Process Dynamics," **Transactions of ASME: Journal of Engrg. for Industry**, **107**(4), 336-342 (with S. Yang and S. M. Wu) (1985).
26. "Cutting Dynamics Identification by Dynamic Data System (DDS) Modeling Approach," **Transactions of ASME: Journal of Engrg. for Industry**, **107**(2), 91-94 (with T. Y. Ahn and S. M. Wu) (1985).
27. "Transfer Function of Cutting Dynamics in Three- Dimensional Cutting," **Proc. 13th Annual North American Manufacturing Research Conference**, Berkeley, CA, 476-481 (with I. N. Tansel) (1985).
28. "Dynamic Assessment of the Trajectory Errors for Robots," **Proc. 13th Annual North American Manufacturing Research Conference**, Berkeley, CA, 546-550 (with S. H. Lee and B. T. Wu) (1985).

1986.

29. "A New Approach to Form Accuracy Control in Machining," **International Journal of Production Research**, **24** (4), 825-838 (1986), also *Toward the Factory of the Future* H. -J. Bullinger and H. J. Warnecke, eds. (**Proc. 8th International Conference on Production Research**, Stuttgart, West Germany), Springer Verlag, 416-424 (1985).
30. "Time Domain Approach to Multiple Input Modal Analysis," **Proc. 14th Annual North American Manufacturing Research Conference**, Minneapolis, MN, 471-478, (with D. W. Cho and S. M. Wu) (1986).
31. "Feasibility of Form Accuracy Identification and Control in Cylindrical Grinding," **Intl. Journal of Machine Tool Design and Research**, **26**(3), 259-266 (with K. H. Kim and S. M. Wu) (1986).
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167. "Dynamics of Initial Penetration in Drilling: Part 2 – Motion Models for Drill Skidding and Wandering With Experimental Verification," **ASME Journal of Manufacturing Science and Engineering**, **127**, 289-297 (with Y. Gong, C. Lin) (2005).
168. "An International Assessment of Micro-manufacturing Technology," **Proc. Processing and Fabrication of Advanced Materials XIV with Frontiers in Materials Science 2005: Innovative Materials & Manufacturing Techniques**, Eds. T.S. Srivatsan, R.A. Varin, R. Abbaschian, and S. Viswanathan, **Materials Science & Technology** 211-224 (with B. Allen, D. Bourell, M. Culpepper, R. E. DeVor, T. Hodgson, T. Kurfess, M. Madou, K. Rajurkar) (2005).
169. "A New Camera Calibration Method and Its Applications," **Proc. ICAM2005: International Conference on Advanced Manufacture** Nov. 28 – Dec. Taipei, Taiwan, I011, (with Chuang-Yu Tsai, Chi-Kuen Sung, Psang Dain Lin) (2005).

2006.

170. "Material Characterization of NiTi Based Shape Memory Alloys Fabricated by the laser Direct Metal Deposition Process", **ASME Journal of Manufacturing Science and Engineering**, **128**(3), 691-696 (with K. Malukhin) (2006)
171. "Manufacturing of Shape Memory Alloy Based Monolithic Functional Structures with Shape Memory Effect Properties," **Transactions of NAMRI/SME** **34**, 261-268 (with K. Malukhin) (2006).
172. "Prediction of Cutting Forces in Micro-End-Milling Using the Cutting-Condition-Independent Cutting Force Coefficients," **Transactions of NAMRI/SME** **34**, 453-459 (with H. Lee, D.W. Cho, T. Jo Ko, W-S. Yun) (2006).
173. "An Experimental Investigation of the Feasibility of 'Self-Sensing' Shape Memory Alloy Based Actuators," **Proc. 1st International Conference on Micromanufacturing**, September 13-15, University of Illinois at Urbana-Champaign, 19, 231-236 (with K. Malukhin) (2006)
174. "Third-Octave-Mode Chatter in rolling. Part 1: Chatter Model," **Proc. Inst. Mech. Eng. Part B: Journal of Engineering Manufacture**, **220**, 1267-1277, (with P.H. Hu and H. Zhao) (2006).

175. "Third-Octave-Mode Chatter in rolling. Part 2: Stability of a Single-Stand Mill," **Proc. Inst. Mech. Eng. Part B: Journal of Engineering Manufacture**, **220**, 1279-1292, (with P.H. Hu and H. Zhao) (2006).
176. "Third-Octave-Mode Chatter in rolling. Part 3: Stability of a Multi-Stand Mill," **Proc. Inst. Mech. Eng. Part B: Journal of Engineering Manufacture**, **220**, 1293-1303, (with P.H. Hu and H. Zhao) (2006).
177. "Regenerative Chatter in High-Speed Tandem Rolling Mills," **Proc. MSEC ASME International Conference**, October 8-11, Yspilanti, MI, in print (with H. Zhao) (2006).
178. "A Monolithic Shape Memory Alloy Based Micro/Meso Scale Manipulator," **Proc. 5th International Workshop on Microfactories**, Besancon, France, October 25-27, IWFMF06, Paper #11, (with K. Malukhin) (2006).

C. INVITED LECTURES AND TALKS:

1. McMaster University, Hamilton, Canada--"Machine Tool Dynamics Analysis through Time Series Methods," June (1981).
2. University of California-Berkeley--"Forecasting Control of Chatter in Turning," May (1981).
3. Ford Motors (Detroit)--"Adaptive Control for Robotics--Speed and Position Accuracy," April (1984).
4. IBM Manufacturing Technology Institute (New York)-- "On-Line Modeling Using the DDS Approach," June (1984).
5. University of Wisconsin-Madison (Manufacturing Systems Engineering Seminar)--"Forecasting Compensatory Control of Form Accuracy--A Systems Approach," February (1984).
6. IBM (Endicott)--"Drilling Research at the University of Wisconsin-Madison," October (1984).
7. Northwestern University (Evanston)--"Compensatory Control of Form Accuracy in Machining," November (1984).
8. University of Florida (Gainesville)--"Machine Tool Dynamics and Accuracy," December (1984).
9. IBM Manufacturing Technology Institute (New York)-- "Applications of Time Series Modeling in Manufacturing," December (1984).
10. University of Cincinnati (Cincinnati)--"Dynamics and Accuracy of Metal Cutting Machine Tools," May (1985).
11. University of Illinois (Urbana-Champaign)--"Machine Tool Accuracy and Dynamics," November (1985).
12. The University of Illinois at Chicago (Chicago)-- "Stochastic Analysis and Control of Machine Tools," November (1986).
13. Beijing Agricultural Engineering University Beijing, PRC)--"Time Series Methods for Structural Dynamics Analysis," August (1988).
14. Huazhong University of Science and Technology (Wuhan, PRC)--"Stochastic Dynamics and Control of Machine Tool and Robotic Systems," (series of 10 lectures) September (1988).
15. Syracuse University (Syracuse)--"Surface Topography Control in Die Manufacture," October (1989).
16. The University of Michigan (Ann Arbor)--"Accuracy Issues in the Manufacture of Sculptured Die Surfaces," November (1989).
17. Pennsylvania State University (University Park)-- "Problems in the Manufacture of Sheet Metal Dies," March (1990).

18. Auburn University (Auburn)-- "Active Compensation for Precision Machining," November 1990.
19. Auburn University (Auburn)-- "Time Series Methods for Identification and Control in Metal Cutting," November 1990.
20. Ford Motor Co. (Detroit) -- " On the Feasibility of a New Generation of Precision Self-Correcting Multi-axis Machines," February 1991.
21. The University of Michigan, (Ann Arbor) -- "Microhole Drilling," May 1991.
22. IIT (Chicago) -- "Geometry and Mechanics of Micro-Hole Drilling." November 1991.
23. University of Kentucky (Lexington) -- "Geometry and Mechanics of Micro-Hole Drilling," March 1992.
24. Tulon Co. (Gardena, CA) -- "Micro-drilling Research at Northwestern," November 1992.
25. Seoul National University (Seoul, Korea) -- "Surface Topography Control in the Manufacture of Sculptured Die Surfaces," June 1993.
26. Korea Advanced Institute of Science & Technology (Taejon, Korea) -- "Geometry and Mechanics of Micro-hole Drilling," June 1993.
27. Korea Advanced Institute of Science & Technology (Taejon, Korea) -- "Active Compensation for Precision Machining," June 1993.
28. Yeungnam University (Teagu, Korea) -- Active Compensation for Precision Machining," June 1993.
29. Universidad De Los Andes (Bogota, Colombia) -- A series of 8 seminars on manufacturing research and education, August, 1993.
30. Wright State University (Dayton, OH) -- " Geometry and Mechanics of Micro-drilling," February, 1994.
31. Northwestern University, Tribology Center, (Evanston, IL) -- "Engineered Surfaces," April 1994.
32. Notre Dame University (South Bend, MI) -- "Geometry, Mechanics, and Performance of Micro-drilling Processes," November 1994.
33. Seoul National University (Seoul, Korea) -- "Machining Dynamics," (Short Course for Graduate Students), June 1995.
34. Seoul National University (Seoul, Korea) -- "Geometry, Mechanics and Performance of Micro-hole Drilling Processes," June 1995.
35. Yeungnam University (Taegu, Korea) -- "An Overview of Research in the Metal Cutting and Machine Tool Laboratory at Northwestern," June 1995.
36. Pohang Institute of Science and Technology (POSTECH) (Pohang, Korea) -- "Dynamics of Metal Cutting Processes," June 1995.
37. National Cheng Kung University (Tainan, Taiwan) -- "An Overview of Research in the Metal Cutting and Machine Tool Laboratory at Northwestern," June 1995.
38. Marquette University (Milwaukee, WI) -- "An Overview of Research in the Metal Cutting and Machine Tool Laboratory at Northwestern," February 1996.
39. Penn State University (College Park, PA) – "An Overview Of Research In The Advanced Manufacturing Laboratory At Northwestern" October 1997.
40. "Assessment and Development of Spade Drill Technology," American Tools, Inc., July 1998.
41. "Stability and Accuracy of Manufacturing Processes," Seminar, University of Michigan Ann Arbor, Dec 4, 1998.
42. "Geometry and Mechanics of Micro-hole Drilling," Assiut University, Assiut, Egypt, March, 20, 1999.
43. "Stability and Accuracy of Manufacturing Processes," Assiut University, Assiut, Egypt, March, 21, 1999.
44. "Chatter in Rolling," Southern Methodist University, Dallas, TX, April 9, 1999.
45. "Error Analysis and Compensation of a Stewart-Platform Based Machine Tool," Georgia Institute of Technology, Atlanta, GA, April 15, 1999.

46. "An Overview of Research in the Advanced Manufacturing Laboratory at Northwestern," Technical University of Budapest, Budapest, Hungary, November 3, 1999.
47. "Error Analysis and Compensation of a Stewart-Platform Based Machine Tool," University of Washington Seattle, January 18, 2000.
48. "Metal Cutting and Machine Tool Related Research in the Advanced Manufacturing Laboratory at Northwestern," GM, Warren, MI, January 28, 2000.
49. "University-Based Research in Machining and Machine Tool Systems: Some Current Trends, Emerging Work, and Future Directions," Association for Manufacturing Technology (AMT) Forum, Orlando, FL, March 3, 2000.
50. "An Overview of Research in the Advanced Manufacturing Laboratory at Northwestern," Computer and Automation Research Institute (SZTAKI), Hungarian Academy of Sciences, Budapest, Hungary, October 12, 2000.
51. "Mechanistic Model For Dynamic Forces in Micro-Drilling," ASME/IMECE, New York, November 2001.
52. "Panel on Packaging Issues in Micro-integrated Nano-systems," ASME/IMECE, New York, November 2001.
53. "Manufacturing Engineering Education; A Unified Approach," The Collaborative Manufacturing Summit, May 29, 2002, Dallas, TX.
54. "Opportunities and Challenges for Mechanical Micro/Meso-Scale Manufacturing," (KEYNOTE presentation), Fifth International Conference on Frontiers of Design and Manufacturing, July 9-13, 2002, Dalian, China.
55. "Micro/Meso-scale Mechanical Manufacturing," Gifu University, Gifu, Japan, July 18, 2002.
56. "Present and Future of Micro/Meso-scale Mechanical Manufacturing," Center for Cooperative Research, Gifu, Japan, July 18, 2002.
57. "An Overview of Micro/Meso-scale Mechanical Manufacturing Process Development," Pacific Industrial, Co, Ltd., Gifu, Japan, July 19, 2002.
58. "Processes and Machines for Micro/Meso-scale Mechanical Manufacturing," PMC, Tai-Chung, Taiwan, July 23, 2002.
59. "Overview of Ongoing Research in the Advanced Manufacturing Laboratory at Northwestern," Chung-Yuan University, Chung-Li, Taiwan, July 24, 2002.
60. "Micro/meso-scale Mechanical Manufacturing – Opportunities and Challenges, March 28, WPI
61. "State-of-the-Art in Micro Machining Research," SME Workshop on "Precision Micro-machining Fundamentals," Minneapolis, MN, June 10, 2003, and Precision Micro Machining Technology & Applications Technical Conference," June 11-12.
62. "Micro/Meso-Scale Machining and Machine Tool System Development," IMECE – Panel presentation, November 2003, Washington, DC.
63. "Micromachining Research with Industrial Applications," IMTS Manufacturing Conference – SME, Session on Micro Machining Technologies, Chicago, September 2004.
64. "Micromanufacturing," Presentation to the House Science Committee, Washington, D.C., April 2005.
65. "Micromachining Research and Development," Workshop on Micromanufacturing Fundamentals, Minneapolis, May 2005.
66. "Summary of Findings of the World Technology Evaluation Center's (WTEC) Study on Micromanufacturing," MicroManufacturing 2005 – Technical Conference and Tabletop Exhibit, SME, Minneapolis, May 2005.
67. "Micromanufacturing: About the Study; Summary and Recommendations," at the "Panel on Micro Manufacturing – a WTEC Study," Thirty-third North American Manufacturing Research Conference, New York, May 2005.

68. "Report on Micro-Manufacturing R&D Worldwide (World Technology Evaluation Center 2005 Study on Micromanufacturing), MicroManufacturing Workshop, Rockford, Illinois, July 2005.
69. "Micro/Meso-Scale Machine Tool Research and Development," Microfactory – International Workshop, Jeju Island, Korea, July 2005.
70. "Micromanufacturing Research and Development at Northwestern University," Korea Institute of Machinery and Metals (KIMM), Daejeon, Korea, July 2005.
71. "Micro-Manufacturing – A Synopsis of R&D Worldwide and at Northwestern," University of Wisconsin-Madison, WI, September 9, 2005.
72. "Micro-manufacturing Research and Development – State-of-the-art in the U.S.," (Keynote presentation), 1st Topical Meeting on Desktop MEMS and Nano-factories (TMMF 2005), Tsukuba, Japan, October 17, 2005.
73. "Micro-manufacturing Research and Development – State-of-the-art in the U.S.," (Keynote presentation), International Forum on Desktop Factories (DTF 2005), Suwa, Japan, October 20, 2005.
74. "Development of Micro/meso Machine Tools," Presentation on the panel "Micro-manufacturing – Outlook for the future," ASME-IMECE, Orlando, FL, November 10, 2005.
75. "Micro-Manufacturing: -- An Overview," Brainstorming Session for an Advanced Manufacturing Research Agenda, NSF, Arlington, VA, January 20, 2006.
76. "Micro-Manufacturing Research and Technology," "Overview of Micromanufacturing Processes," "Metrology for Micro-Manufacturing Applications," and "Microfactory Concepts," Workshop on Microsystems Manufacturing Technologies, CMERI – Central Mechanical Engineering Research Institute, Durgapur, India, January 30-February 1, 2006.
77. "Microfabrication Methods (based on "Traditional" processes)," "Shape Memory Alloy based Micro/Meso-Scale Monolithic Manipulator (mMM)," and "Development of High Speed Fluid Bearing Spindles for Meso-Scale Machine Tools (mMTs)," Lecture Series on Micro Manufacturing, Indian Institute of Technology (IIT) Kanpur, India, February 4-6, 2006.
78. "State-of-the-Art of Micro-manufacturing Research and Development," (Keynote presentation) International Precision Assembly Seminar IPAS'2006, Bad Hofgastein, Austria, February 19-22, 2006.
79. "Current State of Micro/Meso-Scale Machining and Machine Tool Systems Research," and "MicroManufacturing Research and Development – A State-of-the-Art Assessment," MicroManufacturing 2006 Conference and Exhibits, Los Angeles, CA, March 29-30, 2006.
80. "Overcoming Barriers in the Manufacture of Small Components and Devices," (Invited presentation), NIBIB/NHLBI/NSF Workshop on "Improving Health Care Accessibility Through Point-of-Care Technologies," April 11-12, 2006.
81. "A State-of-the-Art Assessment of Micro-manufacturing," Symposium on Nano Rapid Prototyping for Photonic Structures, Western Carolina University, Cullowhee, April 27-28, 2006
82. "Overview of the Technology and Business Case for Micro-Manufacturing," Boston Scientific Corporation – Corporate Metals Technology Team – Mid-year Meeting, Pacific Grove, CA, May 11, 2006.
83. "Study on Advanced Manufacturing Research and Technology," World Technology Evaluation Center (WTEC) – NSF Workshop, Washington, DC, June, 6, 2006.
84. "Overview of the Technology and Business Case for Micro Manufacturing," Micro Manufacturing Engineering - New opportunities in manufacturing," (Keynote presentation) Dublin, Ireland, June 13, 2006.
85. "Current Status of World Wide Micro Manufacturing Research," (Keynote presentation) The 7th International Conference on Frontiers of Design and Manufacturing, Guangzhou, China, June 19-22, 2006.

86. "Micro-Manufacturing Research at Northwestern – Cutting and Manipulation," National Taiwan University, Taipei, Taiwan, July 3, 2006
87. "Micro-Manufacturing – A Synopsis of R&D Worldwide and at Northwestern," 2006 International Micro-Manufacturing Workshop, Chung Yuan Christian University, Chung Li, Taiwan, July 4, 2006.
88. "Recent Developments in Meso-scale Machine Tools (mMTs),," 2nd International Workshop on Next-Generation Microfactory System, KIMM, Daejeon, Korea, July 6, 2006.
89. "Report on: WTEC Study on Advanced Manufacturing Research and Technology," 2006 NSF/DMI Grantees and Research Conference, St. Louis, MO, July 25-27, 2006.
90. "Micromaching Research and Development – A State-of-the-art Assessment," Competitive Manufacturers Conference at IMTS2006: New and Emerging Technologies: Micro Machining Technologies, September 6-8, 2006.