

Curriculum Vitae

MING C. LEU

1. PRESENT POSITION AND CONTACT INFORMATION

Keith and Pat Bailey Distinguished Professor
Director, Intelligent Systems Center
320 Engineering Research Laboratory
Missouri University of Science and Technology
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2. EDUCATION

Ph.D. Mechanical Engineering, 1981, University of California, Berkeley, CA.
M.S. Mechanical Engineering, 1977, Pennsylvania State University, University Park, PA.
B.S. Mechanical Engineering, 1972, National Taiwan University, Taipei, Taiwan.

3. RESEARCH INTEREST

Additive Manufacturing, Rapid Prototyping, CAD/CAM, Intelligent Robotics, Artificial Intelligence, Machine dynamics and Control, Modeling and Simulation, Design and Manufacturing Automation, Virtual and Augmented Reality.

4. EXPERIENCE

4a. Employment

8/99-present **Keith and Pat Bailey Distinguished Professor**
Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology. Teaching and research in the area of integrated product development with emphasis on digital design and manufacturing, additive manufacturing, rapid prototyping, CAD/CAM, virtual and augmented reality, and mechatronics. Developing laboratory facilities and project activities for research and education. Mentoring students, post-docs, and junior faculty.

10/03-6/20 **Director, Intelligent Systems Center (ISC)**
Missouri University of Science and Technology. Directing the research activities of this state-funded center so as to integrate the

knowledge and expertise of faculty investigators from different academic departments to build cross-disciplinary research teams, with the objectives to attract more external research funding and to generate greater research impacts. Developed five research thrust areas and identifying critical and emerging research topics for these areas: Intelligent Manufacturing Processes, Equipment and Systems; Intelligent Cyber Physical Systems; Advanced Simulation, Sensing, Control and Communication; Computational Intelligence and Embedded Systems; and Cyber Security and Trustworthiness. Creating a stimulating academic environment for nurturing of junior faculty and training of graduate students.

5/04-5/16 **Director, Center for Aerospace Manufacturing Technologies (CAMT)**

Missouri University of Science and Technology. Founded CAMT in 2004 with Boeing as the main industrial partner and initial funding from U.S. Air Force Research Laboratory. Directing and managing this center's research activities. Developing industry and government partnerships, technology transition paths, and future research directions. Established CAMT Industrial Consortium in 2007 aimed at research, development and transitioning of advanced manufacturing technologies to the aerospace manufacturing supply chain.

9/96-8/99 **Program Director, Manufacturing Processes and Equipment**

National Science Foundation. Directing and managing fundamental research activities for support of academic researchers leading to the development of novel manufacturing processes and next-generation machines and equipment. Reviewing proposals for funding and monitoring progress of funded projects. Identifying critical and emerging research topics for future program activities. Coordinating with other federal agencies. Promoting NSF funded research and university-industry collaboration.

7/87-8/99 **New Jersey State Chair Professor in Manufacturing Productivity**

Department of Mechanical Engineering, New Jersey Institute of Technology. Establishing a program of excellence in robotics, rapid prototyping, and intelligent manufacturing. Teaching and research on CAD/CAM, robotics, rapid prototyping, intelligent manufacturing, and control systems. Developing teaching and research laboratories and project activities. Mentoring students, post-docs, and junior faculty.

8/81-6/87 **Assistant Professor**

Sibley School of Mechanical and Aerospace Engineering, Cornell University. Teaching robotics, manufacturing processes, system

dynamics, and microprocessor applications. Research in robotics, CAD/CAM, optimal design, automatic control, and electromechanical systems.

- 1/78-8/81 **Research Assistant**
Dynamic Stability Laboratory, Department of Mechanical Engineering, University of California, Berkeley. Research on mechanisms of vibration and noise generation in rotating cutters.
- 9/77-12/77 **Teaching Assistant**
Department of Mechanical Engineering, University of California, Berkeley. Assistance in teaching mechanical design.
- 4/77-8/77 **Research Assistant**
Applied Research Laboratory, Pennsylvania State University. Research on reduction of plate vibration and force transmission by use of stiffening ribs and damping layers.
- 9/75-3/77 **Research Assistant**
Pennsylvania Transportation Institute, Pennsylvania State University. Research on effects of pavement texture on tire skid friction.
- 9/74-8/75 **Teaching Assistant**
Department of Mechanical Engineering, National Taiwan University. Assistance in teaching machine design and strength of materials.

4b. Other Experiences

- Visiting Professor, Nanyang Technological University, Singapore, 2/19-5/19, 5/18, 7/16-8/16.
- Visiting Professor, Xi'an Jiaotong University, Xi'an, China, 6/10-7/10.
- Visiting Professor, National Taiwan University, Taipei, Taiwan, 9/93-8/94.
- Visiting Professor, University of Natal, Durban, South Africa, 7/93-8/93.
- Consulting Experience: Siemens, Mo-Sci, O'Fallon Casting, MetaStable Instruments, Siemens, Moog, Ford Motor, AT&T, Universal Instruments, Teltech, MARCO (Canada), and MIRL/ITRI (Taiwan).

5. HONORS AND AWARDS

- The International Freeform and Additive Manufacturing Excellence (FAME) Award, 2020, the International Solid Freeform Fabrication Symposium, for outstanding contributions to the field of freeform/additive fabrication.

Milton C. Shaw Manufacturing Research Medal, 2018, ASME (American Society of Mechanical Engineers), for significant fundamental contributions to the science and technology of manufacturing processes.

Best Paper Recognition, 2018, IISE (Institute of Industrial and Systems Engineers) Data Analytics & Information Systems Track, for the paper "American Sign Language Alphabet Recognition Using Leap Motion Controller" by W. Tao, Z. Lai, M. C. Leu and Z. Yin.

President's Leadership Award, 2017, University of Missouri System, for having provided exceptional leadership in the University of Missouri System (consisting of four universities).

Best Paper Recognition, 2017, the International Solid Freeform Fabrication Symposium, for the paper "Building Zr-based Metallic Glass Part on Ti Alloy by Laser-Foil-Printing Additive Manufacturing" by Y. Li, Y. Shen, M. C. Leu, and H-L. Tsai.

Best Paper Recognition, 2015, IEEE (Institute of Electrical and Electronics Engineers) Computer Society Workshop on Observing and Understanding Hands in Action, for the paper "American Sign Language Alphabet Recognition Using Microsoft KINECT" by C. Dong, M. C. Leu, and Z. Yin.

Blackall Machine Tool and Gage Award, 2014, ASME, for the most outstanding paper published in the ASME's Journal of Manufacturing Science and Engineering during the preceding two years.

Best Paper Recognition, 2014, the International Solid Freeform Fabrication Symposium, for the paper "In Vitro Assessment of Laser Sintered Bioactive Glass Scaffolds with Different Pore Geometries" by K. C. R. Kolan, A. Thomas, M. C. Leu, and G. E. Hilmas.

Hideo Hanafusa Outstanding Investigator Award, 2008, ISFA (International Symposium on Flexible Automation), for sustained outstanding contributions to the field of flexible automation.

Dedicated Service Award, 2004, ASME, for dedicated services to the American Society of Mechanical Engineers.

Research Excellence Award, 2001 & 2004, AMAE (Academy of Mechanical and Aerospace Engineering) of Missouri S&T, for outstanding research performance among the faculty of Missouri S&T's Department of Mechanical and Aerospace Engineering.

University Lead Award, 1994, CASA/SME (Computer and Automated Systems Association of the Society of Manufacturing Engineers), in recognition of the leadership and excellence of a university team in the application and development of integrated manufacturing.

Industrial Ecology Faculty Fellowship, 1994, AT&T, for an in-depth study of industrial ecology as a driving force for research, curriculum, and public policy change.

Harlan J. Perlis Research Award, 1993, NJIT (New Jersey Institute of Technology), for the most outstanding research among the university's faculty.

Presidential Young Investigator Award, 1985, NSF (National Science Foundation), in recognition of ability and potential for contributing to the scientific and engineering effort of the United States.

Ralph R. Teetor Education Award, 1985, SAE (Society of Automotive Engineers), in recognition of contributions to research, teaching, and student development.

Wood Award, 1981, FPRS (Forest Products Research Society), for the best paper "Flow-Induced Vibration in Circular Saws," by M. C. Leu and C. D. Mote, Jr.

Earle C. Anthony Scholarship, 1977-80, for excellent academic standing at the University of California-Berkeley.

South Sea Textile Inc. Fellowship, 1970-72, for the highest academic standing among all applicants from the National Taiwan University.

Fellow of SME, elected 2018.

Fellow of CIRP (The International Academy of Production Engineering), elected 2008.

Fellow of ASME, elected 1993.

Member, EU Academy of Sciences (EUAS).

Member, Sigma Xi, Tau Beta Pi, and Phi Kappa Phi honor societies.

Ingram's One of 50 Missourians You Should Know, 2020.

Listing in Who's Who in the World, Who's Who in America, Who's Who in the East, Who's Who in Science and Engineering, Who's Who in Technology Today, Who's Who in American Education, Who's Who of Emerging Leaders in America, Who's Who Among Executives and Professionals, etc.

6. PROFESSIONAL SERVICE ACTIVITIES

6a. Society Services

Editorial Board Member, Journal of Virtual and Physical Prototyping, 2005-present.

Editorial Board Member, CIRP Journal of Manufacturing Science and Technology, 2009-present.

Editorial Board Member, International Journal of Manufacturing Engineering, 2012-present.

Editorial Board Member, Journal of Systems Integration, 1990-2000.

Editor for the Ceramic Additive Manufacturing Processes Division, ASM Handbook on Additive Manufacturing, 2019.

Guest Editor, Special Issue on Bioprinting in USA, International Journal of Bioprinting, 2019.

Advisory Committee Member, Solid Freeform Fabrication Symposium, 2009-present.

Co-Organizer and Co-Chair, NSF CAREER Proposal Writing Workshop, 2016.

Advisory Committee Co-Chair, ASME/ISCIE International Symposium on Flexible Automation, 2014.

Co-Organizer and Co-Chair, NSF Workshop on Frontiers of Additive Manufacturing Research and Education, 2013.

Member of Scientific Committee, CIRP Conference on Manufacturing Systems, 2013.

Member of Scientific Committee, International Symposium on Electromachining (ISEM), 2013.

Conference Chair, ASME/ISCIE International Symposium on Flexible Automation, 2012.

Conference Co-Chair, ASME/ISCIE International Symposium on Flexible Automation, 2010.

Co-Organizer and Co-Chair, NSF Workshop on Roadmap for Additive Manufacturing: Identifying the Future of Freeform Processing, 2009.

Organizer and Chair, 2nd Aerospace Manufacturing Technologies Conference, 2009.

Organizer and Chair, 1st Aerospace Manufacturing Technologies Conference, 2008.

Member of Organizing/Program/Advisory Committee, ASME/ISCIE International Symposium on Flexible Automation, 1988, 1990, 1996, 1998, 2000, 2002, 2008, 2010, 2012, 2014, 2016, 2018 and 2020.

Organizer and Chair, 2006 NSF Design, Service and Manufacturing Research and Grantees Conference.

General Chair, ASME International Mechanical Engineering Conference, 2006.

Advisory Committee Co-Chair, ASME/ISCIE International Symposium on Flexible Automation, 2006.

Technical Program Chair, ASME International Mechanical Engineering Conference, 2005.

Advisory Committee Chair, ASME/ISCIE International Symposium on Flexible Automation, 2004.

Vice President-Manufacturing, ASME, 1999-2002.

Representative of ASME Manufacturing Technical Group to the ASME Engineering and Global Technologies Committee, 1995-1998.

Organizer, Chair, and Proceedings Editor, Symposium on University-Industry-Government Cooperative Research, National Taiwan University, 1994.

Conference Co-Chair, ASME/ISCIE International Symposium on Flexible Automation, 1994.

Co-organizer. Co-Chair, and Proceedings Co-editor, Symposium on Computer-Controlled Machines for Manufacturing, ASME Winter Annual Meeting, 1993.

Program Chair, ASME/ISCIE International Symposium on Flexible Automation, 1992.

Chair, ASME Manufacturing Engineering Division, 1989-1990.

Executive Committee Member, ASME Manufacturing Engineering Division, 1986-1990.

Organizer, Chair, and Proceedings Editor, Symposium on Advanced Manufacturing, New Jersey Institute of Technology, 1990.

Vice Chair, IEEE International Conference on Systems Integration, 1990.

Co-organizer, Co-Chair, and Proceedings Co-editor, Symposium on High Energy Beam Manufacturing, ASME Winter Annual Meeting, 1989.

Organizer, Chair, and Proceedings Editor, Symposium on High-Tech Manufacturing: Meeting the Needs of Industries, New Jersey Institute of Technology, 1989.

Organizer, Chair, and Proceedings Editor, Symposium on Robotics and Manufacturing Automation, ASME Winter Annual Meeting, 1985.

Organizer, Chair, and Proceedings Editor, Symposium on Computer-Integrated Manufacturing and Robotics, ASME Winter Annual Meeting, 1984.

Co-organizer, Co-Chair, and Proceedings Co-editor, Symposium on Computer-Integrated Manufacturing, ASME Winter Annual Meeting, 1983.

Referee of proposals for the National Science Foundation (General Research Grants, Research Initiation Grants, Research Equipment Grants, CAREER Grants, Engineering Research Center Grants, etc.), Indiana 21st Century Science and Technology Fund, University of Missouri Research Board, Science Foundation Ireland, Agency for Science, Technology and Research of Singapore, Research Grants Council of Hong Kong, etc.

Referee of papers for (among others):

ASME Journal of Manufacturing Science and Engineering

ASME Journal of Dynamic Systems, Measurement and Control

ASME Journal of Mechanical Design

IEEE Transactions on Robotics and Automation

IEEE Transactions of Automation Science and Engineering

International Journal of Advanced Manufacturing Technology

International Journal of Robotics Research

International Journal of Hydrogen Energy

Journal of Virtual and Physical Prototyping

Journal of Manufacturing Systems

Journal of Materials and Design

Journal of Materials Processing Technology

Journal of Power Sources

Journal of Robotic Systems

Journal of Systems Integration

Journal of Sound and Vibration

Rapid Prototyping Journal

Computer-Aided Design Journal

ASME International Mechanical Engineering Conference

IEEE Robotics and Automation Conference

American Control Conference

Solid Freeform Fabrication Symposium

International Symposium on Flexible Automation

International Symposium on Electromachining

Reviewer of books for:

Addison Wesley, Prentice Hall, and Applied Mechanics Review.

6b. University Services

Chair, Advanced Manufacturing Signature Area (Missouri S&T), 2014-present.

Member, MAE Department Promotion and Tenure Committee (Missouri S&T), 2001-present; Chair, 2000-2001.

Member, Campus Promotion and Tenure Committee (Missouri S&T), 2012-2014.

Chair, MAE Department Chair Search Committee (Missouri S&T), 2009-2010.

Chair, MAE Department Manufacturing Faculty Search Committee (Missouri S&T), 1999-2000, 2012-2013, 2015-2016.

Chair, Advanced Manufacturing Signature Area Faculty Search Committee (Missouri S&T), 2014-2015, 2017-2018.

Chair, People Subcommittee, Research Capacity Task Force Committee (Missouri S&T), 2011-2012.

Chair, Faculty Workload Committee (Missouri S&T), 2006-2007.

Chair, MAE Department Graduate Seminar Committee (Missouri S&T), 2000-2004.

Member, MAE Department Design and Manufacturing Technical Committee (Missouri S&T), 1999-present; Chair, 2000-2004, 2013-2015.

Member, University Manufacturing Education Executive Committee (Missouri S&T), 1999-present.

Member, Provost Search Committee (Missouri S&T), 2006.

Member, Vice Provost-Research Search Committee (Missouri S&T), 2006.

Member, F. Kenneth Iverson Chair Search Committee (Missouri S&T), 2006.

Member, MAE Department Academic Curriculum Committee (Missouri S&T), 1999-2004.

Member, MAE Department Graduate Affairs Committee (Missouri S&T), 1999-2004.

Member, Engineering College Committee on Curriculum Planning and Development (NJIT), 1994-1996.

Member, Institute Committee on Long Range Planning (NJIT), 1988-1996.

Member, Institute Committee on Graduate Studies and Research (NJIT), 1988-1993.

Member, Search Committee for Chairperson of Dept. of Industrial and Manufacturing Engineering (NJIT), 1995.

Member, Institute Committee on Promotion and Tenure (NJIT), 1989-1991.

Chair, Institute Committee on CIM Laboratories Planning & Development (NJIT), 1988-1990.

Organizer, Mechanical Engineering Colloquium (NJIT), 1987-1990.

Member, Mechanical Engineering Promotion and Tenure Committee (NJIT), 1987-1989, 1991-1996.

Member, Mechanical Engineering Graduate Studies and Research Committee (NJIT), 1987-1996.

Co-organizer, Sibley School Colloquium (Cornell), 1986-1987.

Member, College Committee on Academic Standards, Petitions and Credit (Cornell), 1985-86.

Secretary, Sibley School Faculty (Cornell), 1984-85.

7. PUBLICATIONS

7a. Theses

1. M.S. Thesis, *Relationship Between Skidding Resistance and Pavement Texture*, Dept. of Mechanical Engineering, Pennsylvania State University, University Park, PA, Aug. 1977.
2. Ph.D. Dissertation, *Source of Noise and Vibration in Idling Circular Saws and Its Control by Tooth Design*, Dept. of Mechanical Engineering, University of California, Berkeley, CA, Aug. 1981.

7b. Books and Book Chapters

1. “Deformed Swept Volume Analysis of NC Machining Simulation with Cutter Deflection,” M. C. Leu, D. Blackmore and B. Maitech, *Machining Impossible Shape*, Kluwer, 1999, pp. 158-166.
2. “Interactive Solid Modeling in a Virtual Environment with Haptic Interface,” X. Peng and M. C. Leu, *AR/VR Applications in Manufacturing*, Springer-Verlag, 2004.
3. “Engineering Applications of Virtual Reality,” X. Peng and M. C. Leu, *Mechanical Engineers’ Handbook on Materials and Mechanical Design*, 3rd Edition, John Wiley and Sons, 2005, pp. 732-761.
4. “A Web-Based Intelligent Collaborative System for Engineering Design,” X. Liu, S. Raorane, and M. C. Leu, *Collaborative Product Design & Manufacturing Methodologies and Applications*, Editors: W. D. Li, Chris McMahon, S. K. Ong and Andrew Y. C. Nee, Springer, 2007, pp. 37-58.
5. “Virtual Bone Surgery,” M. C. Leu, Q. Niu and X. Chi, *Virtual Prototyping & Bio Manufacturing in Medical Applications*, Editors: Bopaya Bidanda and Paulo Bartolo, Springer, 2008.
6. “Chapter 8: Digital Design and Fabrication of Dental Restorations,” M. C. Leu and P. Delli, *Bio-Materials and Prototyping Applications in Medicine*, Editors: Bopaya Bidanda & Paolo Bartolo, Springer, 2008, pp. 125-155.
7. “An Intelligent Computational Argumentation System for Supporting Collaborative Software Development Decision Making,” X. Liu, E. Khudkhudia, L. Wen, V. Sajja, and M. C. Leu, *Artificial Intelligence Applications for Improved Software Engineering Development: New Prospects*, Editors: Farid Meziane and Sunil Vadera, IGI Global Publisher, 2009.
8. *Roadmap for Additive Manufacturing: Identifying the Future of Freeform Processing*, Editors: D. L. Bourell, M. C. Leu, D. W. Rosen, Laboratory for Freeform Fabrication, University of Texas, 92 pages, 2009.
9. *Unigraphics for Engineering Design*, S. Shinde and M. C. Leu, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2004.
10. *NX3 for Engineering Design*, P. Delli and M. C. Leu, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2005.

11. *NX5 for Engineering Design*, M. C. Leu and A. Joshi, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2008.
12. *NX7 for Engineering Design*, M. C. Leu, A. Joshi and K. Kolan, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2011.
13. "Sensor (Assembly)," M. C. Leu, in *Encyclopedia of Production Engineering*, Springer, Mar. 2014.
14. *NX9 for Engineering Design*, M. C. Leu, A. Thomas, and K. Kolan, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2014.
15. *NX10 for Engineering Design*, M. C. Leu, A. Ghazanfari, and K. Kolan, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2015.
16. *NX12 for Engineering Design*, M. C. Leu, W. Tao, A. Ghazanfari, and K. Kolan, Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, 2018.
17. "Sensor (Assembly)," M. C. Leu, in *Encyclopedia of Production Engineering*, Springer, Dec. 2018, doi:10.1007/978-3-642-35950-7_6630-3.
18. "Manufacturing Assembly Simulations in Virtual and Augmented Reality," W. Tao, Z-H. Lai, and M. C. Leu, *Augmented, Virtual, and Mixed Reality Applications in Advanced Manufacturing*, Editor: S. K. Gupta, World Scientific Publishing Company, 2020 (in press).

7c. Edited Volumes of Conference Proceedings

1. *Proceedings of Symposium on Computer-Integrated Manufacturing*, edited by M. R. Martinez and M. C. Leu, ASME Winter Annual Meeting, PED-Vol. 8, 1983.
2. *Proceedings of Symposium on Computer-Integrated Manufacturing and Robotics*, edited by M. C. Leu and M. R. Martinez, ASME Winter Annual Meeting, PED-Vol. 13, 1984.
3. *Proceedings of Symposium on Robotics and Manufacturing Automation*, edited by M. C. Leu and M. Donath, ASME Winter Annual Meeting, PED-Vol. 15, 1985.
4. *Proceedings of Symposium on High-Tech Manufacturing: Meeting the Needs of Industry*, edited by M. C. Leu, New Jersey Institute of Technology, May 1989.
5. *Proceedings of Symposium on High Energy Beam Manufacturing Technologies*, edited by E. S. Geskin and M. C. Leu, ASME Winter Annual Meeting, PED-Vol. 46, 1989.
6. *Proceedings of Symposium on Advanced Manufacturing*, edited by M. C. Leu and R. J. Caudill, New Jersey Institute of Technology, Jun. 1990.
7. *Proceedings of 1992 Japan-USA Symposium on Flexible Automation*, edited by M. C. Leu, ASME Publication, Jul. 1992.

8. *Proceedings of Symposium on University-Industry-Government Cooperative Research*, edited by M. C. Leu and K. C. Fan, National Taiwan University, Jul. 1994.

7d. Journal Papers

1. "Prediction of Skid Resistance as a Function of Speed from Pavement Texture Measurements," M. C. Leu and J. J. Henry, **Transportation Research Board**, TRR 666, 1978, pp. 7-13.
2. "Whistling Instability in Circular Saws," C. D. Mote, Jr. and M. C. Leu, **ASME Journal of Dynamic Systems, Measurement and Control**, Vol. 102, No. 2, Jun. 1980, pp. 114-122.
3. "Pressure Fluctuations on the Surface of a Parallelogram Prism Protruding from a Rotating Circular Disk," M. C. Leu and C. D. Mote, Jr., **Journal of Acoustic Society of America**, Vol. 72, No. 5, Nov. 1982, pp. 1583-1585.
4. "Simulation of Robot Kinematics Using Interactive Computer Graphics," M. C. Leu and R. Mahajan, **ASEE Journal of Computers in Education**, Vol. 4, No. 1, 1984, pp. 11-19.
5. "Origin of Idling Noise in Circular Saws and Its Suppression," M. C. Leu and C. D. Mote, Jr., **Journal of Wood Science and Technology**, Vol. 18, 1984, pp. 33-49. (This paper won an FPRS Wood Award.)
6. "Vortex Shedding: The Source of Noise and Vibration in Idling Circular Saws," M. C. Leu and C. D. Mote, Jr., **ASME Journal of Vibration, Acoustics, Stress and Reliability in Design**, Vol. 106, No. 3, Jul. 1984, pp. 434-441.
7. "Modeling and Analysis of Flow-Induced Vibration in Circular Saws," M. C. Leu and J. Jiropongphan, **ASME Journal of Vibration, Acoustics, Stress and Reliability in Design**, Vol. 107, No. 2, Apr. 1985, pp. 196-202.
8. "Robotics Software Systems," M. C. Leu, **International Journal of Robotics and Computer-Integrated Manufacturing**, Vol. 2, No. 1, 1985, pp. 1-12.
9. "Geometric Representation of Translational Swept Volumes and Its Applications," M. C. Leu, S. H. Park, and K. K. Wang, **ASME Journal of Engineering for Industry**, Vol. 108, No. 2, May 1986, pp. 113-119.
10. "Automated Symbolic Derivation of Dynamic Equations of Motion for Robotic Manipulators," M. C. Leu and N. Hemati, **ASME Journal of Dynamic Systems, Measurement, and Control**, Vol. 108, No. 3, Sept. 1986, pp. 172-179.
11. "Computer Generation of Robot Dynamic Equations and Related Issues," J. Koplík and M. C. Leu, **Journal of Robotic Systems**, Vol. 3, No. 3, 1986, pp. 301-319.
12. "A First Robotics Course for Senior/Graduate Engineering Students," M. C. Leu, **ASEE Journal of Computers in Education**, Vol. 6, No. 4, 1986, pp. 1-8.

13. "Optimal Trajectory Generation for Robotic Manipulators Using Dynamic Programming," S. Singh and M. C. Leu, **ASME Journal of Dynamic Systems, Measurement and Control**, Vol. 109, No. 2, Jun. 1987, pp.88-96.
14. "Effect of Mechanical Compliance on Deflection of Robot Manipulators," M. C. Leu, V. Dukovski, and K. K. Wang, **Journal of Manufacturing Technology – CIRP Annals**, Vol. 36, No. 1, 1987, pp.305-309.
15. "A Case Study of Robotic Assembly for a Printer Compensation Device," M. C. Leu and M. S. Weinstein, **Journal of Manufacturing Systems**, Vol. 7, No. 2, 1988, pp. 163-170.
16. "Robot Motion Simulation and Planning Based on Solid Modeling," M. C. Leu, **Journal of Manufacturing Technology – CIRP Annals**, Vol. 37, No. 1, 1988, pp. 141-144.
17. "Characteristics and Optimal Design of Variable Air Gap Linear Force Motors," M. C. Leu, E. V. Scorza, and D. L. Bartel, **IEE Electrical Power Applications**, Vol. 135, No. 6, Nov. 1988, pp. 341-345.
18. "PDF Subvariable Control and Its Applications to Robot Motion Control," M. C. Leu and D. I. Freed, **ASME Journal of Dynamic Systems, Measurement and Control**, Vol. 111, Sept. 1989, pp. 452-461.
19. "A Vision System for Three-Dimensional Positional Measurement Based on Stereo Disparity," M. C. Leu and R. M. Pherwani, **Optics and Laser Technology**, Vol. 21, No. 5, 1989, pp.319-324.
20. "On the Design of Optical Triangulation Devices," Z. Ji and M. C. Leu, **Optics and Laser Technology**, Vol. 21, No.5, 1989, pp. 335-338.
21. "A Robot Vision System for 3-D Metrology," T.-Q. Kim, M. C. Leu, Z. Ji and F. Y. Shih, **Transactions of NAMRI/SME**, 1990, pp. 290-297.
22. "Macintosh II_x and IBM PC Based Automatic Control Laboratory," Y. Park M. C. Leu, and G. Y. Zhou, **ASEE Journal of Computers in Education**, Sept. 1990, pp. 42-46.
23. "Control and Simulation of Servo Motor Systems Using Macintosh II_x," Y. Park and M. C. Leu, **International Journal of Mechanical Engineering Education**, Vol. 18, No. 4, 1990, pp. 281-293.
24. "Geometric Representation of Swept Volumes with Application to Polyhedral Objects," J. D. Weld and M. C. Leu, **International Journal of Robotics Research**, Vol. 9, No. 5, Oct. 1990, pp. 105-117.
25. "Inverse Kinematics of Calibrated Industrial Robots," Z. Ji and M. C. Leu, **Journal of Robotic Systems**, Vol. 7, No. 5, Oct. 1990, pp. 675-687.
26. "Robust Nonlinear Control of Brushless DC Motors for Direct Drive Robotic Applications," N. Hemati, J. S. Thorp and M. C. Leu, **IEEE Transactions on Industrial Electronics**, Vol. 37, No. 6, Dec. 1990, pp. 460-468.
27. "Manipulator Motion Planning in the Presence of Obstacles and Dynamic Constraints," S. K. Singh and M. C. Leu, **International Journal of Robotics Research**, Vol. 10, No. 2, Apr. 1991, pp.171-187.
28. "Feasible and Optimal Designs of Variable Air Gap Torque Motors," M. C. Leu and R. A. Aubrecht, **ASME Journal of Engineering for Industry**, Vol. 113, No.2, May 1991, pp. 241-245.

29. "Uncertainty and Compliance of Robot Manipulators," D. K. Pai and M. C. Leu, **International Journal of Robotics Research**, Vol. 10, No. 3, Jun. 1991, pp. 200-213.
30. "Studying Manipulator Kinematics and Dynamics with Aid of MATHEMATICA," M. C. Leu, Z. Ji and Y. S. Wang, **International Journal of Mechanical Engineering Education**, Vol. 19, No. 3, 1991, pp. 213-228.
31. "Modeling and Performance Analysis of a Flexible PCB Assembly Station Using Petri Nets," M. Zhou and M. C. Leu, **ASME Journal of Electronic Packaging**, Vol. 113, Dec. 1991, pp. 410-416.
32. "A Complete Model Characterization of Brushless DC Motors," N. Hemati and M. C. Leu, **IEEE Transactions on Industry Applications**, IA-28, No. 1, Jan./Feb. 1992, pp. 172-180.
33. "Vision Based Tool Calibration and Accuracy Improvement for Assembly Robots," Z. Ji, M. C. Leu and P. F. Lilienthal, **Journal of Precision Engineering**, Vol. 14, No. 3, Jul. 1992, pp. 168-175.
34. "Applications of Flows and Envelopes to NC Machining," D. Blackmore, M. C. Leu and K. K. Wang, **Journal of Manufacturing Technology – CIRP Annals**, Vol. 42, No. 1, 1992, pp. 493-496.
35. "Genericity and Singularities of Robot Manipulators," D. K. Pai and M. C. Leu, **IEEE Transactions on Robotics and Automation**, Vol. 8, No. 5, Oct. 1992, pp. 545-559.
36. "Application of Linear Assignment Model for Planning of Robotic Printed Circuit Board Assembly," Z. Ji, M. C. Leu, and H. Wong, **ASME Journal of Electronic Packaging**, Vol. 114, Dec. 1992, pp. 455-460.
37. "Analysis of Swept Volume via Lie Groups and Differential Equations," D. Blackmore and M.C. Leu, **International Journal of Robotics Research**, Vol. 11, No. 6, Dec. 1992, pp. 516-537.
38. "Mapping of Kinematic and Dynamic Parameters for Coupled Manipulators," Z. Ji and M. C. Leu, **ASME Journal of Mechanical Design**, Vol. 115, Jun. 1993, pp. 283-288.
39. "Adaptive Genetic Algorithm for Optimal Printed Circuit Board Assembly Planning," H. Wong and M. C. Leu, **Journal of Manufacturing Technology – CIRP Annals**, Vol. 43, No. 1, 1993, pp. 17-20.
40. "Fractal Geometry Model for Wear Prediction," G. Y. Zhou, M. C. Leu, and D. Blackmore, **Wear**, Vol. 170, Nov. 1993, pp. 1-14.
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281. “Additive Manufacturing of Metal Bandpass Filters for Future Radar Receivers,” Bradley Grothaus, A. T. Sutton, M. C. Leu, and B. Brown, **Proceedings of Solid Freeform Fabrication Symposium**, Austin, TX, Aug. 13-15, 2018.
282. “A Region-Based Deep Learning Algorithm for Detecting and Tracking Objects in Manufacturing Plants,” M. M. Karim, D. Doell, R. Lingard, Z. Yin, M. C. Leu, and R. Qin, **Proceeding of 25th International Conference on Production Research Manufacturing Innovation: Cyber Physical Manufacturing**, Chicago, IL, Aug. 9–14, 2019.

283. "Action Recognition in Manufacturing Assembly using Multimodal Sensor Fusion," M. Al-Amin, W. Tao, D. Doell, R. Lingard, Z. Yin, M. C. Leu, and R. Qin, **Proceeding of 25th International Conference on Production Research Manufacturing Innovation: Cyber Physical Manufacturing**, Chicago, IL, Aug. 9–14, 2019.
284. "A Brief Review on 3D Bioprinted Skin Substitutes," F. Fayyazbakhsh and M. C. Leu, **Procedia Manufacturing**, Vol. 48, Jun. 2020.
285. "Real-Time Assembly Operation Recognition with Fog Computing and Transfer Learning for Human-Centered Intelligent Manufacturing," W. Tao, M. Al-Amin, H. Chen, M. C. Leu, Z. Yin, and R. Qin, **Procedia Manufacturing**, Vol. 48, Jun. 2020.
286. "Feasibility and Characterization of Large-Scale Additive Manufacturing with Long Fiber Reinforced Composites," A. R. Thakur, M. C. Leu, and X. Dong, **Proceedings of the ASME 2020 Manufacturing Science and Engineering Conference (MSEC 2020)**, Jun. 22-26, 2020, Cincinnati, OH.
287. "Dynamic Gesture Design and Recognition for Human-Robot Collaboration with Convolutional Neural Networks," H. Chen, W. Tao, M. C. Leu, and Z. Yin, **Proceedings of the 2020 International Symposium on Flexible Automation (ISFA 2020)**, Jul. 5-9, 2020, Chicago, IL.
288. "Action Completeness Modeling with Background Aware Networks for Weakly-Supervised Temporal Action Localization," M. Moniruzzaman, Z. Yin, Z. He, R. Qin, and M. C. Leu, **Proceedings of ACM Multimedia Conference 2020**, Oct. 12-16, 2020, Seattle, WA.
289. "Design of a Real-Time Human-Robot Collaboration System Operated by Dynamic Gestures," H. Chen, M. C. Leu, W. Tao and Z. Yin, **Proceedings of the ASME 2020 International Mechanical Engineering Congress and Exposition (IMECE 2020)**, November 13-19, 2020, Portland, OR.
290. "Additively Manufactured Interdigital Filters for Ultra-Wideband Radar," Fernando Rodriguez-Morales, Ben Brown, Austin Sutton, Ming Leu, Frank Liou, Sean Garrison, and Ambrose Wolf, **Proceedings of 2021 IEEE Radio & Wireless Week (RWW 2021)**, Jan. 17 – 20, 2021, San Diego, CA. (accepted)
291. "Collaborative Forward and Backward Teacher-Student Learning for Long-Term Future Action Anticipation," M. Moniruzzaman, Z. Yin, Z. He, R. Qin, and M. C. Leu, **Proceedings of CVPR 2021 Conference (Virtual)**, Jun. 19-25, 2021 (under review).

8. PATENTS

1. "Nonlinear Displacement Sensor Based on Optical Triangulation Principle," M. C. Leu and Z. Ji, U.S. Patent No. 5,113,080, issued on May 12, 1992. (This patent was licensed to WYKO Corporation in Arizona.)
2. "Method and Apparatus for Rapid Freezing Prototyping," W. Zhang, M. C. Leu, Z. Ji, and Y. Yan, U.S. Patent No. 6,253,116, issued on Jun. 26, 2001.

3. "Rapid Production of Engineering Tools and Hollow Bodies by Integration of Electroforming and Solid Freeform Fabrication," B. Yang and M. C. Leu, U.S. Patent No. 6,409,902, issued on Jun. 25, 2002.
4. "Computer Aided Dental Bar Design," M. C. Leu and A. Gawate, U.S. Patent No. 7,747,418, issued on Jun. 29, 2010.
5. "Method and Apparatus for Fabricating Ceramic and Metal Components via Additive Manufacturing with Uniform Layered Radiation Drying," M. C. Leu, A. Ghazanfari, W. Li, G. E. Hilmas, and R. G. Landers, U.S. Patent No. 10,259,158, issued on Apr. 16, 2019.

9. TEACHING AND ADVISING ACTIVITIES

9a. Courses Taught

Advanced Digital Design and Manufacturing*
 Advanced Topics in Robotics*
 Automatic Control
 Automation in Manufacturing
 Computer Aided Manufacturing
 Computer Applications in Mechanical Engineering Design
 Fundamentals of Manufacturing Processes*
 Introduction to Manufacturing Engineering
 Introduction to Mechanical Engineering
 Introduction to Robotics*
 Linear Systems in Mechanical Engineering
 Materials and Manufacturing Processes
 Microprocessor Applications
 Multi-axis Motion Planning and Control*
 Principles and Practice of Computer Aided Design*
 Systems Dynamics

* New courses developed by M. C. Leu

9b. Teaching Laboratories Developed or Significantly Improved

Automatic Control Laboratory
 Intelligent Manufacturing & Robotics Laboratory
 Manufacturing Processes Laboratory
 Microprocessor Applications Laboratory
 PACE (Partnership for Advanced Collaborative Engineering Education)
 Laboratory
 Systems Dynamics Laboratory

9c. Graduate Students and Post-Docs Mentored

Missouri S&T (1999-present): Main advisor of 16 Ph.D. and ~90 M.S. students who have graduated) and ~20 post-docs and visiting scholars.

NJIT (1987-1999): Main advisor of 9 Ph.D. and 23 Master students and 8 post-docs.

Cornell (1981-87): Main advisor of 4 Ph.D. and 21 Master students and 1 post-doc.

9d. Names, Graduation Years, and Current Affiliations of Ph.D. Advisees

1. John Weld, 1987, Alcatel-Lucent Technologies, Inc.
2. Neyram Hemati, 1988, Western Digital Technologies, Inc.
3. Dinesh Pai, 1989, University of British Columbia (Canada).
4. Sunil Singh, 1989, GlobalLogic Inc.
5. Jack G. Zhou, 1993, Drexel University.
6. Hermean Wong, 1995, Total Tel Communications, Inc.
7. Hsin-Te Liao, 1995, Ming-Hsin Institute of Technology (Taiwan).
8. Tea-Quin Kim, 1996, Samsung Corporation (Korea).
9. Ping Meng, 1996, Alcatel-Lucent Technologies, Inc.
10. Liping Wang, 1997, Kane University.
11. Wen-Long Yao, 1998, National Kaoshiung First University of Science and Technology (Taiwan).
12. Bo Yang, 2000, Pitney Bowes, Inc.
13. Bilal Maiteh, 2000, Delphi Automotive Systems.
14. Guanghua Sui, 2002, Vaxdesign, Inc.
15. Qingbin Liu, 2005, Sentry Pumping International, Inc.
16. Xiaobo Peng, 2005, Prairie View A&M University.
17. Xiaoyi Chi, 2006, Environmental Systems Research Institute.
18. Tieshu Huang, 2007, Missouri University of Science and Technology.
19. Qiang Niu, 2008, General Motors Corporation.
20. Weihang Zhang, 2008, Glidewell Laboratories.
21. Frances Bryant, 2008, Missouri University of Science and Technology.
22. Jen-Chi Wu, 2009, MiTAC Technology Corporation (Taiwan).
23. Akul Joshi, 2010, Bharat Forge America Inc.
24. Nannan Guo, 2013, Microsoft Corp.
25. Krishna Kolan, 2015, Missouri University of Science and Technology.
26. Mingyang Li, 2016, Nanyang Technological University (Singapore).
27. Amir Ghazanfari, 2017, San Jose State University.
28. Wenbin Li, 2019, Flexiv Ltd.
29. Yingqi Li, 2019, Gestamp Corp.
30. Austin Sutton, 2020, Los Alamos National Laboratory.
31. Wenjin Tao, 2020, Foxconn Industrial Internet (Fii) USA.
32. Chia-Hung Hung, 2021 (exp.)
33. M. Hossein Sehhat, 2022 (exp.)
34. Sachin Choudhary, 2022 (exp.)
35. Haodong Chen, 2023 (exp.)

36. Tunay Turk, 2024 (exp.)
37. Niloofar Zendehtdel, 2024 (exp.)

10. GRANTS

1. "Automation and Optimization of Torque Motor Design," awarded by Moog Inc., \$36,380, 1982-1984 (PI: M.C. Leu, Co-PI: D. Bartel).
2. "Modeling and Analysis of Flow-Induced Vibration in Circular Saws," awarded by the Engineering Foundation, \$16,000, 1982-1983 (PI: M.C. Leu).
3. "Dynamic Simulation of Robot Motion Using Interactive Computer Graphics," awarded by Cornell Computer-Aided Design Instruction Facility, \$20,000, 1982-1983 (PI: M.C. Leu).
4. "Research Initiation and Curriculum Development in Robotics," awarded by the Manufacturing Engineering Education Foundation of SME, \$5,250, 1983-1984 (PI: M.C. Leu).
5. "Robust Control of Mechanical Manipulator Motion," awarded by the National Science Foundation, \$50,689, 1983-1985 (PI: M.C. Leu).
6. "Robotics Research in Mechanical Engineering," awarded by Cornell Manufacturing Engineering and Productivity Program, \$23,200, 1984-1985 (PI: M.C. Leu).
7. "Optimal Design of Linear Force Motors," awarded by Moog Inc., \$29,445, 1984-1985 (PI: M.C. Leu, Co-PI: D. Bartel).
8. "Modeling, Analysis and Control of Brushless DC Motors," awarded by Moog Inc., \$100,890, 1985-1988 (PI: M.C. Leu).
9. "Microprocessor Applications and Computer Numerical Control," awarded by IBM's Project Ezra at Cornell University, six IBM PC/AT computers with interface boards and printers worth approx. \$40,000, 1986 (PI: M.C. Leu).
10. "Presidential Young Investigator Award: Robot Dynamics and Control," awarded by the National Science Foundation, \$320,314, 1985-1990 (PI: M.C. Leu).
11. "Industrial Matching Funds for Presidential Young Investigator Award," awarded by Ford Motor Co., \$17,500; General Electric, \$53,340; AT&T Information Systems, \$27,150; Convergent Technologies, \$30,000; Deneb Robotics, \$4,500, 1985-90 (PI: M.C. Leu).
12. "Program of Sponsored Chair in Manufacturing Productivity," NJIT Chair Professorship Research Funds, approx. \$150,000 per year, 1987-1996.
13. "Computer Based Control and Instrumentation for Mechanical Engineering Laboratory Courses," awarded by New Jersey's Department of Higher Education, \$87,833, 1988-89 (PI: M.C. Leu, Co-PI's: B. Koplik, A. Harnoy, H. Pawel).
14. "Engineering Research Equipment Grant: Vibration Excitation and Measurement System," awarded by the National Science Foundation, \$40,811, 1989-1990 (PI: M.C. Leu, Co-PI's: A. Rosato, C. Wilson).

15. "Engineering Research Equipment Grant: High-Speed Motion Analysis System," awarded by the National Science Foundation, \$59,000, 1990-1991 (PI: I. Fischer, Co-PI's: M.C. Leu, A. Rosato, R. Dave).
16. "Optimal Planning for Placement of Printed Circuit Board Components," awarded by Universal Instruments Corp., \$41,451, 1991 (PI: M.C. Leu).
17. "AT&T Manufacturing Technology Special Grant," awarded by AT&T Foundation, \$225,000, 1989-1992 (PI: K. O'Brien, Co-PI's: M.C. Leu, R. Sodhi, K. McDermott, N. Levy).
18. "Flexible Automated Machining, Assembly and Packaging," awarded by AT&T Bell Laboratories and AT&T Manufacturing Affiliates Grants Program, \$106,000, plus donation of equipment worth approx. \$500,000, and co-awarded by the New Jersey Advanced Technology Center for Manufacturing Systems, \$81,200, 1989-1994 (PI: M.C. Leu).
19. "Studying Sweeps and Swept Volumes via Differential Equation Approach," awarded by the National Science Foundation, \$135,000, 1991-1993 (PI: M.C. Leu, Co-PI: D. Blackmore).
20. "Representation and Analysis of Swept Volumes with Tolerances and Deformations," awarded by the Office of Naval Research, \$613,231, and co-awarded by the New Jersey Advanced Technology Center for Manufacturing Systems, \$121,625, 1992-1995 (PI: M.C. Leu, Co-PI's: D. Blackmore, F. Shih).
21. "Waterjet In-Situ Cleaning," awarded by the NSF Emission Reduction Research Center, \$253,597, 1993-1996 (PI: E. Geskin, Co-PI: M.C. Leu).
22. "Japan-USA Symposium on Flexible Automation (Travel Fund)," awarded by the National Science Foundation, \$55,000, 1994-1995 (PI: M.C. Leu).
23. "Symposium on University-Industry-Government Cooperative Research," awarded by the National Science Foundation and Department of Education in Taiwan, NT\$1,200,000, 1994 (PI: M.C. Leu, Co-PI: K.C. Fan).
24. "Industrial Ecology as a Force for Research, Curriculum and Public Policy Change," awarded by AT&T Industrial Ecology Faculty Fellowship Program, \$100,000, 1994-1996 (PI: D. Watts, Co-PI's: M.C. Leu, R. Caudill, H. Shaw, D. Hawk, M. Dekadt).
25. "Manufacturing Practice in Engineering Education," awarded by the NSF/DARPA Technology Reinvestment Project, \$1,550,000, 1994-1997 (PI: W. Swart, Co-PI's: M.C. Leu, N. Elliot).
26. "Application of Sweep differential Equations to Automated Manufacturing," awarded by the National Science Foundation, \$140,000, 1995-1998 (PI: D. Blackmore, Co-PI: M.C. Leu).
27. "Intergovernmental Personnel Act Agreement for Program Director Assignment," awarded by the National Science Foundation, \$615,415, 1996-1999 (PI: M.C. Leu).
28. "Multi-lifecycle Engineering and Rapid Prototyping for the 21st Century," awarded by New Jersey Commission on Science and Technology, approx. \$5,000,000, 1996-2000 (PI's: R. Caudill, D. Sebastian, S. Danforth, Co-PI's: M.C. Leu, S. Das, M. Xanthos, E. Ehrenkrantz and others).

29. "Rapid Freeform Fabrication of Ice Parts," awarded by the University of Missouri System Research Board, \$25,367, 2000-2001 (PI: M.C. Leu, Co-PI: W. Zhang).
30. "Development of a Virtual and Augmented Reality System for Research in Intelligent Design and Manufacturing," awarded by the National Science Foundation, \$461,401, 2000-2003 (PI: M. C. Leu, Co-PIs: S. Agarwal, V. Allada, Y. Fu, R. H. Hall, R. T. Kellogg, K. Krishnamurthy, F. W. Liou, X. Liu, A. Midha, O. R. Mitchell, D. Wunsch).
31. "Matching Support for NSF Project: Development of a Virtual and Augmented Reality System for Research in Intelligent Design and Manufacturing," awarded by Missouri S&T's Manufacturing Research and Training Center and Missouri Department of Economic Development, \$388,082, 2000-2003 (PI: M. C. Leu, Co-PIs: S. Agarwal, V. Allada, Y. Fu, R. H. Hall, R. T. Kellogg, K. Krishnamurthy, F. W. Liou, X. Liu, A. Midha, O. R. Mitchell, D. Wunsch).
32. "Partners for the Advancement of Collaborative Engineering (PACE) Education," awarded by the PACE Consortium, 46 Sun Ultra workstations valued at \$161,000 and 250 NX licenses and other software plus support and training, 2000-2003 (PI: M. C. Leu, Co-PIs: O. R. Mitchell, A. Midha, D. McAdams).
33. "Development of a Virtual Reality Laboratory and Related Activities," awarded by Ford Motor Company, \$250,000, 2000-2005 (PI: M. C. Leu, Co-PIs: O. R. Mitchell, A. Midha, M. Bird).
34. "Development of a Product Focused Manufacturing Program," awarded by the Society of Manufacturing Engineers Education Foundation, \$182,000, 2001-2003 (PI: F. Liou, Co-PIs: A. Agarwal, V. Allada, M.C. Leu, R. S. Mishra, A. C. Okafor).
35. "Acquisition of a High-Power CO₂ Laser for Research and Education in Manufacturing and Materials Processing," awarded by the National Science Foundation, \$200,000, 2001-2003 (PI: H. Tsai, Co-PIs: J. Choi, R. Landers, M. C. Leu, A. Midha, M. N. Rahaman, J. G. Story, D. C. Van Aken).
36. "Design and Development of Refractive Devices for Directing Laser Beams," awarded by MetaStable Instruments Inc., \$30,000, 6/1/01-5/31/02 (PI: M.C. Leu, Co-PIs: F. Liou, D. McAdams).
37. "GAANN: Doctoral Research and Training in Virtual and Rapid Prototyping," awarded by the Department of Education, \$362,280, 08/15/01-08/14/05 (PI: M. C. Leu, Co-PIs: J. Choi, F. Liou, R. G. Landers, D. A. McAdams, A. C. Okafor, H. Tsai, A. Midha).
38. "STTR: Solid Freeform Fabrication Based Dental Reconstruction: Phase I & Phase II," awarded by the National Science Foundation (with a Subaward from Tel Med Technologies to Missouri S&T), \$622,000, 1/1/02-12/31/06 (PI: S. Schmitt, co-PI: M.C. Leu).
39. "Gateway to Manufacturing Excellence Project," awarded by the National Science Foundation (with a Subaward from St. Louis Community College at Florissant Valley to Missouri S&T), \$672,880, 05/15/02-04/30/06 (PI: A. Agrawal, co-PIs: M.C. Leu, F. Liou, F. Terrence, D. Gerstenecker).

40. "Rapid Freeze Prototyping and Investment Casting Application," awarded by the National Science Foundation, \$92,000, 06/15/02-05/31/04 (PI: M. C. Leu, co-PI: V. Richards).
41. "Advanced Virtual Environment for First Responders," awarded by the Army Tank-automotive and Armaments Command, \$1,050,000, 08/21/02-1/31/05 (PI: M C. Leu, Co-PIs: M. Hilgers, S. Agarwal, R. Hall).
42. "Development of a Parallel Machine Tool for Research and Education in Advanced Manufacturing," awarded by the National Science Foundation, \$166,058, and matched by the Missouri Research Board, \$15,000, 05/01/03-04/30/05 (PI: R. Landers, Co-PIs: M. C. Leu, L. Acar, S. N. Balakrishnan, M. G. Hilgers, B. M. McMillin, F. Liou, A. C. Okafor, C. Saygin).
43. "Development of a Virtual Reality System for Simulated Bone Drilling with Haptics Interface," awarded by DePuy Orthopaedics, Inc., \$138,630, 5/1/03-4/30/05 (PI: M.C. Leu).
44. "An Architecture for Productive Collaboration Among Small and Medium-Sized Enterprises," awarded by the National Science Foundation, \$106,000, 8/1/03-7/31/05 (PI: C. Saygin, Co-PIs: S. Grasman, M. C. Leu).
45. "Accuracy and Stability of Computational Representations of Swept Volume Operations," awarded by the National Science Foundation (with a Subaward from NJIT to Missouri S&T), \$468,000, 9/1/03-8/31/07 (PI: D. Blackmore, co-PIs: M.C. Leu, W. Regli, W. Sun).
46. "Dynamic Fastening Simulation," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies \$521,363, 5/1/04-7/31/07 (PI: S. L. Murray, co-PI: M C. Leu).
47. "Fabrication of Near Net-Shaped Ceramic Parts by Rapid Freeze Prototyping and Freeze Drying," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies, \$625,316, 5/1/04-7/31/06 (PI: M C. Leu, Co-PIs: F. Dogan, G. Hilmas).
48. "CAMT Program Integration and Management," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies \$2,042,875, 5/1/04-4/30/10 (PI: M C. Leu, co-PIs: R. Landers, D. Summers, F. Liou, H. Tsai, R. Mishra, M. O'Keefe, R. Zoughi, K. Chandrashekhara, D. Pommerenke).
49. "2006 NSF Design, Service and Manufacturing Grantees and Research Conference," awarded by the National Science Foundation, \$304,258, 3/1/05-2/28/08 (PI: M. C. Leu).
50. "Matching Support for 2006 NSF Design, Service and Manufacturing Grantees and Research Conference," awarded by Boeing, Emerson, the Research Alliance of Missouri, and the Auto/Steel Partnership, \$40,000, 3/1/05-2/28/08 (PI: M. C. Leu).
51. "Planning Grant: Proposal for Industry/University Cooperative Research Center Site on Intelligent Maintenance Systems," awarded by the National Science Foundation, \$10,000, 7/15/05-6/30/06 (PI: J. Sarangapani, Co-PIs: M. C. Leu, C. Saygin).

52. "Rapid Prototyping of Complex Ceramic Components and Graded Composites for Hot Structures," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies, \$295,000, 8/1/05-7/31/07 (PI: M C. Leu, Co-PIs: F. Dogan, G. Hilmas).
53. "Selective Laser Sintering of Ultra High Temperature Ceramics," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies, \$267,180, 8/1/05-7/31/07 (PI: M C. Leu, Co-PIs: F. Dogan and G. Hilmas).
54. "Development of System-Level Maintenance System for Compressors," awarded by the NSF I/UCRC on Intelligent Maintenance Systems at Missouri S&T, \$40,000, 7/1/06-6/30/07 (PI: M. C. Leu).
55. "Two (2) DTM2000 Sinter Stations for Selective Laser Sintering Research," donated by Boeing company, valued at \$97,140, 1/1/06-12/31/06 (PI: M. C. Leu, Co-PIs: F. Dogan, G. Hilmas).
56. "Development of Collaborative Engineering Design Education Projects," awarded by General Motors Corporation via the PACE Consortium, \$21,000 in cash plus two computer stations, 7/1/06-6/30/08 (PI: M. C. Leu).
57. "STTR: Rapid Freeze Prototyping of Investment Cast Thin Wall Metal Matrix Composites: Phase I," awarded by the National Science Foundation (with a Subaward from O'Fallon Casting Company to Missouri S&T), \$149,990, 1/1/07-12/31/07 (PI: T. Hill, Co-PIs: V. Richards, M.C. Leu).
58. "Synthesis and Evaluation of Markings for Truck Mounted Attenuators," awarded by Iowa Department of Transportation and Missouri S&T's University Transportation Center, \$60,000, 9/1/07-6/30/09 (PI: G. Bham, Co-PI: M.C. Leu).
59. "A Simulator for Fastening Operation and Dynamic Ergonomics Analysis," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies with matching support from CAMT Industrial Consortium, \$64,000 (plus \$86,000 industry software in-kind matching), 10/1/07-9/30/09 (PI: M C. Leu, Co-PI: S. L. Murray).
60. "Automated CAD Model Based Simulation of Manufacturing Operations," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies, \$122,788, 10/1/07-9/30/09 (PI: M C. Leu, Co-PI: X. F. Liu).
61. "Direct Digital Manufacture of Near Net-Shape Parts with Ultra-High Temperature Ceramics," awarded by the Air Force Research Laboratory via Missouri S&T's Center for Aerospace Manufacturing Technologies, \$187,212, 10/1/07-9/30/09 (PI: M C. Leu, Co-PIs: F. Dogan, G. Hilmas, R. Landers).
62. "2008 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/08-12/31/08 (PI: M. C. Leu).
63. "CAD Model Based Simulation of Manufacturing Operations Using Dynamic Data Configuration and Real-time Motion Capture," awarded by

- Missouri S&T's CAMT Industrial Consortium, \$80,000, 7/1/08-6/30/10 (PI: M. C. Leu, Co-PI: X. F. Liu).
64. "Roadmap for Additive Manufacturing (RAM) Workshop: Identifying the Future of Freeform Processing," awarded by the National Science Foundation and the Office of Naval Research, \$66,992, 1/1/09-12/31/09 (PI: D. L. Bourell, Co-PIs: M. C. Leu, D. W. Rosen).
 65. "Freeze Extrusion Fabrication of Bone Scaffolds with Bioactive Glass," awarded by Missouri S&T's Consortium for Bone and Tissue Repair and Regeneration (CBTRR), \$19,850, 1/1/09-12/31/09 (PI: M. C. Leu).
 66. "2009 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/09-12/31/09 (PI: M. C. Leu).
 67. "SBIR: Selective Laser Sintering of Bioglass Scaffolds for Bone Tissue Engineering: Phase I," awarded by the National Science Foundation (with a Subaward from MoSci Corporation to Missouri S&T), \$100,000, 7/1/09-12/31/09 (PI: M. Velez, Co-PIs: M.C. Leu, R. F. Brown, G. E. Hilmas).
 68. "Advanced Military Installations Integrating Renewable Energy and Advanced Energy Storage Technologies: Task 2," awarded by the Air Force Research Laboratory, \$862,500, 7/10/09-9/9/12 (PI: F. Liou, Co-PIs: C. Chandrashekhara, R. G. Landers, M. C. Leu, J. Newkirk).
 69. "GOALI: Freeze-form Extrusion Fabrication of Composite Structures Using Ultra High Temperature Ceramics and Refractory Metals," awarded by the National Science Foundation, \$312,000, 8/1/09-7/31/12 (PI: M.C. Leu., Co-PI: G. E. Hilmas, R. G. Landers, M. W. Hayes, S. Lawton).
 70. "Matching Support for NSF GOALI Project: Freeze-form Extrusion Fabrication of Composite Structures Using Ultra High Temperature Ceramics and Refractory Metals," awarded by Boeing Company, \$60,000, 8/1/09-7/31/12 (PI: M.C. Leu, Co-PI: G. E. Hilmas, R. G. Landers, M. W. Hayes, S. Lawton).
 71. "A Low-Cost Motion Tracking System for Virtual Reality Applications," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000plus \$43,000 industry software in-kind matching), 10/1/09-9/30/10 (PI: M. C. Leu, Co-PI: X. F. Liu).
 72. "Landmine Detection Simulator," awarded by Leonard Wood Institute (with a Subaward from Advanced Military Equipment Corporation to Missouri S&T), \$544,950, 9/1/09-12/31/10 (PI: J. Plunkett, Co-PIs: M. C. Leu, K. Wedge, B. M. Davis).
 73. "Advanced Electric Drive Vehicles," awarded by the National Energy Technology Laboratory, \$5,000,000, 1/1/10-12/31/12 (PI: M. Ferdowsi, Co-PIs: K. T. Erickson, J. W. Kimball, J. W. Sheffield, S. Long, R. H. Hall, S. E. Grassman, M. C. Leu, R. G. Landers, S. Corns, K. Corzine, F. Dogan, M. L. Crow).
 74. "2010 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/10-12/31/10 (PI: M. C. Leu).

75. "Conference: 2010 International Symposium on Flexible Automation; Tokyo; Japan; Jul. 12 - 14, 2010," awarded by the National Science Foundation, \$25,000, 3/15/10-6/30/11 (PI: J. Cao, Co-PIs: M. Tomizuka, M. C. Leu).
76. "REU Site: Additive Manufacturing," awarded by the National Science Foundation, \$400,000, 7/15/10-7/14/13 (PI: R. Landers, Co-PIs: M. C. Leu, G. Hilmas, F. Liou, H. Sheng).
77. "Additive Manufacturing of Functionally Gradient Ultra-High Temperature Materials," awarded by the Air Force Research Laboratory, \$197,320, 8/1/10-7/31/12 (PI: M. C. Leu, Co-PI: G. Hilmas).
78. "Ergonomic Analysis Based on Assembly Simulation with Motion Capture," awarded by Missouri S&T's CAMT Industrial Consortium, \$20,000 (plus \$43,000 industry software in-kind matching), 11/1/10-10/31/11 (PI: M. C. Leu, Co-PI: X. F. Liu).
79. "2011 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/11-12/31/11 (PI: M. C. Leu).
80. "SBIR: Biodegradable and Biocompatible Tissue Matrices for Bone Repair: Phase I," awarded by the Office of Naval Research (with a Subaward from MoSci Corporation to Missouri S&T), \$70,000, 1/15/11-7/14/11 (PI: M. Velez, Co-PIs: M. C. Leu, T. G. Chu).
81. "Human-Assisted Manufacturing Model Library," A subaward from Boeing Company of an award by the Defense Advanced Research Project Agency, \$310,543, 6/20/11-5/31/12 (PI: F. Liou, Co-PIs: M.C. Leu, C. Dagli).
82. "Influencing Work Zone Traffic Flow through Variable Messaging Technologies," awarded by Iowa Department of Transportation and matched by Missouri S&T Center for Infrastructure Engineering Studies, \$100,000, 7/1/11-12/31/13 (PI: G. Bham, Co-PI: M.C. Leu).
83. "Bio-inspired Design, Fabrication and Testing of Bipolar Plates for PEM Fuel Cells," awarded by the National Science Foundation, \$357,061, 8/15/11-7/31/15 (PI: M.C. Leu, Co-PI: U. Koylu).
84. "Development of a Portable Turn-Key Motion Capture System for Shop-Floor Use," awarded by Missouri S&T's CAMT Industrial Consortium, \$40,000 (plus \$43,000 industry software in-kind matching), 1/1/12-12/31/12 (PI: M. C. Leu, Co-PI: X. F. Liu).
85. "Temporary Fastener for Aerospace Automation: Design and Analysis," awarded by Missouri S&T's CAMT Industrial Consortium, \$30,000, 1/1/12-12/31/12 (PI: M. C. Leu).
86. "2012 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/12-12/31/12 (PI: M. C. Leu).
87. "Technology Development Support for the Boeing DARPA-C2M2L Program Area 3," a subaward from Boeing Company of an award by the Defense Advanced Research Project Agency, \$300,000, 1/19/12-11/21/12 (PI: F. Liou, Co-PI: M.C. Leu).

88. "Alternative Materials to Beryllium for Future Additive Manufacturing Application," awarded by Lockheed Martin Company, \$70,000, 7/10/12-13/31/13 (PI: M. C. Leu. Co-PI: G. E. Hilmas).
89. "GAANN: Doctoral Research and Training in Direct Digital Manufacturing," awarded by Department of Education, \$399,798 (plus \$133,266 from Missouri S&T matching), 8/16/12-8/15/15 (PI: R. G. Landers, Co-PI's: M. C. Leu, D. A. Bristow, K. Chandrashekhara, and M. Rahaman).
90. "MRI: Development of an Open-Source Dual-Probe Atomic Force Microscope," awarded by National Science Foundation, \$316,044 (plus \$135,447 from Missouri S&T matching), 9/15/12-8/31/15 (PI: D. A. Bristow, Co-PIs: M. C. Leu, J. A. Switzer, R. J. Stanley, J. Sarangapani).
91. "Temporary Fastener for Aerospace Automation: Prototyping and Testing," awarded by Missouri S&T's CAMT Industrial Consortium, \$20,000, 1/1/13-12/31/13 (PI: M. C. Leu).
92. "Sparse-Build Tooling by Fused Deposition Modeling for Composites Manufacturing," awarded by Missouri S&T's CAMT Industrial Consortium, \$40,000 (plus \$50,000 industry material & equipment matching), 1/1/13-12/31/13 (PI: M. C. Leu).
93. "2013 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/13-12/31/13 (PI: M. C. Leu).
94. "NSF Workshop on Frontiers of Additive Manufacturing Research and Education," awarded by the National Science Foundation, \$49,465, 3/15/13-3/14/14 (PI: Y. Huang, Co-PI: M. C. Leu).
95. "Sparse-Build Rapid Tooling by Fused Depositing Modeling (FDM) for Composite Manufacturing and Hydroforming," awarded by America Makes – National Additive Manufacturing Innovation Institute, \$191,523, plus \$145,000 industry matching and \$100,000 Missouri S&T matching, 4/1/13-4/30/14 (PI: M. C. Leu, Co-PI: K. Chandrashekhara).
96. "Student Travel Support for 2014 International Symposium on Flexible Automation; Kobe, Japan; 14-16 Jul. 2014," awarded by the National Science Foundation, \$25,000, 9/1/13-12/31/14 (PI: R. G. Landers, Co-PIs: M. C. Leu, R. X. Gao).
97. "Additive Manufacturing of Smart Parts with Embedded Sensors for In-Situ Monitoring in Advanced Power Generation Systems," awarded by the Department of Energy, \$1,499,978, plus \$379,449 university matching, 10/1/13-9/30/16 (PI: H. Tsai, Co-PIs: H. Xiao, M. C. Leu, J. Dong).
98. "Sparse-Build FDM Tooling for Autoclave Processing," awarded by Missouri S&T's CAMT Industrial Consortium, \$55,000 (plus \$50,000 industry material & equipment matching), 1/1/14-12/31/14 (PI: M. C. Leu, Co-PI: K. Chandrashekhara).
99. "2014 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/14-12/31/14 (PI: M. C. Leu).

100. "Healing Chronic Bone Infection Using Bioactive Glass," awarded by the University of Missouri System, \$145,000, 8/1/14-7/31/15 (PI: B. S. Bal, Co-PIs: M. Rahaman, M. C. Leu, K. Katti, C. Phillips, G. Thiagarajan, Y. Wang).
101. "Work Zone Simulator Analysis: Driver Performance and Acceptance of Alternate Merge Sign Configuration," awarded by Missouri Department of Transportation, \$120,037, 10/1/14-9/30/15 (PI: S. Long, Co-PIs: M. C. Leu, B. K. Smith, D. Konur).
102. "2015 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$50,000, 1/1/15-12/31/15 (PI: M. C. Leu, co-PI: D. Bristow).
103. "REU Site: Additive Manufacturing," awarded by the National Science Foundation, \$415,000, 4/1/15-3/31/18 (PI: R. Landers, Co-PIs: D. Bristow, G. Hilmas, J. Newkirk, E. Kinzel).
104. "Metal Additive Manufacturing Materials Analysis," awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$344,423, 5/1/15-9/30/15 (PI: M. C. Leu, Co-PIs: F. Liou, J. Newkirk, E. Kinzel, R. Landers, D. Bristow, and D. O'Malley).
105. "3D Printing of Bone Using Bioactive Glass and Mesenchymal Stem Cells," awarded by the Missouri S&T CASB Best-In-Class Pilot Study Program, \$19,000, 6/1/15-5/31/16 (PI: J. A. Semon, Co-PIs: M. C. Leu, D. E. Day).
106. "EAGER: Cybermanufacturing: Architecture and Protocols for Scalable Cyber-Physical Manufacturing Systems," awarded by the National Science Foundation, \$300,000, 9/1/15-8/31/17 (PI: X. F. Liu, Co-PIs: M. C. Leu, M. X. Cheng).
107. "GAANN: Doctoral Research and Training in Mechatronics," awarded by the Department of Education, \$885,834, 9/1/15-8/31/18 (PI: D. A. Bristow, co-PIs: J. L. Rovey, R. G. Landers, H. Pernicka, L. Duan, E. C. Kinzel, M. C. Leu J. Park, H. Peng, K. J. DeMars).
108. "Metal Additive Manufacturing Materials Analysis," awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$817,381, 10/1/15-9/30/16 (PI: M. C. Leu, Co-PIs: F. Liou, J. Newkirk, E. Kinzel, R. Landers, D. Bristow, L. Chen, and D. O'Malley).
109. "NX-10 for Engineering Design e-book," awarded by Siemens Corp., \$31,000, 10/1/15-9/30/16 (PI: M.C. Leu).
110. "Low-Cost Rapid FDM Tooling with ULTEM 1010," awarded by Missouri S&T's CAMT Industrial Consortium, \$65,000 (plus \$50,000 industry material & equipment matching), 1/1/16-12/31/16 (PI: M. C. Leu, Co-PI: K. Chandrashekhara).
111. "2016 CAMT Industrial Consortium Program Support and Development," awarded by Missouri S&T's CAMT Industrial Consortium, \$90,000, 1/1/16-12/31/16 (PI: M. C. Leu, co-PI: D. Bristow).

112. “2016 NSF CAREER Proposal Writing Workshop; St. Louis, Missouri; Mar. 21-22, 2016,” awarded by the National Science Foundation, \$38,000, 2/1/16-1/31/18 (PI: B. A. Kramer, Co-PI: M. C. Leu).
113. “Integrated Manufacturing Variation Management,” awarded by the Digital Manufacturing and Design Innovation Institute (DMDII), \$276,287. 2/5/16-11/30/17 (PI: D. Bristow, co-PIs: M. C. Leu, R. Landers).
114. “Work Zone Simulator Analysis: Driver Performance and Acceptance of Missouri Alternate Lane Shift Configurations,” awarded by Missouri Department of Transportation, \$75,009, 5/1/16-12/31/16 (PI: S. Long, Co-PIs: M. C. Leu, R. Qin, D. Konur).
115. “An Exploratory Study of Selective Laser Melting for Bonding of 304L Stainless Steel to Cast Iron” \$12,000, awarded by Missouri S&T’s CAMT Industrial Consortium, 7/1/16-12/31/16 (PI: M. C. Leu).
116. “CPS: Synergy: Collaborative Research: Cyber-Physical Sensing, Modeling, and Control with Augmented Reality for Smart Manufacturing Workforce Training and Operations Management,” awarded by the National Science Foundation, \$607,287, 2/1/17-1/31/21 (PI: Z. Yin, Co-PIs: M. C. Leu, R. Qin).
117. “Metal Additive Manufacturing Materials Analysis,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$862,295, 10/1/16-9/30/17 (PI: M. C. Leu, Co-PIs: F. Liou, J. Newkirk, E. Kinzel, R. Landers, D. Bristow, L. Chen, and D. O’Malley).
118. “Additive Manufacturing of Ceramic and Ceramic Composites,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$150,578, 10/1/16-9/30/17 (PI: G. E. Hilmas, Co-PI: M. C. Leu).
119. “Modeling and Simulation of Residual Stresses and Part Deformation in Autoclave Processing with ULTEM 9085 and ULTEM 1010 Tools,” awarded by Missouri S&T’s CAMT Industrial Consortium, \$52,000 (plus \$50,000 industry material & equipment matching), 1/1/17-12/31/17 (PI: M. C. Leu, Co-PI: K. Chandrashekhara).
120. “Metal Additive Manufacturing Materials Analysis,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$813,809, 10/1/17-9/30/18 (PI: M. C. Leu, Co-PIs: F. Liou, J. Newkirk, E. Kinzel, R. Landers, D. Bristow, L. Chen, and D. O’Malley).
121. “Additive Manufacturing of Ceramic and Ceramic Composites,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$174,000, 10/1/17-9/30/18 (PI: G. E. Hilmas, Co-PI: M. C. Leu).
122. “Additive Manufacturing of Metal Bandpass Filters for Future Radar Applications,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$40,000, 10/1/17-9/30/18 (PI: M. C. Leu).

123. “NRI: INT: COLLAB: Manufacturing USA: Intelligent Human-Robot Collaboration for Smart Factory,” awarded by the National Science Foundation, \$683,656, 9/15/18-8/31/22 (PI: Z. Yin, Co-PI: M. C. Leu).
124. “Metal Additive Manufacturing Materials Analysis,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$804,220, 10/1/18-9/30/19 (PI: M. C. Leu, Co-PIs: F. Liou, J. Newkirk, E. Kinzel, R. Landers, D. Bristow, J. Drallmeier, L. Chen, and D. O’Malley).
125. “Additive Manufacturing of Ceramic and Ceramic Composites,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$273,137, 10/1/18-11/30/19 (PI: G. E. Hilmas, Co-PI: M. C. Leu).
126. “GAANN: Doctoral Research and Training in Mechatronics,” awarded by the Department of Education, \$1,194,000, 10/1/18-9/30/21 (PI: R. G. Landers, co-PIs: D. A. Bristow, K. Chandrashekhara, L. Chen, L., X. Dong, E. Kinzel, M. C. Leu, Liou, F.W. Liou, H. Pan, and J. Park).
127. “Development of a Hybrid Carbon Fiber Composites Additive Manufacturing Machine,” awarded by Missouri S&T’s CAMT Industrial Consortium, \$40,000, 1/1/19-12/31/19 (PI: X. Dong, Co-PI: M. C. Leu).
128. “Production of Zero Defect (ZD) Slabs Through the Implementation of SM Technologies in Steel Continuous Casting,” funded by Clean Energy Smart Manufacturing Innovation Institute (CESMII), subcontract from ArcelorMittal USA), \$311,473, 4/1/19-1/31/21 (PI: R. O’Malley, Co-PIs: J. Huang, L. Chen, and M. C. Leu).
129. “Ultra-High Temperature Ceramic Additively Manufactured Compact Heat Exchangers,” awarded by the ARPA-E Program of the Department of Energy, \$964,721, 9/16/19-3/15/21 (PI: D. Lipke, Co-PIs: W. Fahrenholtz G. E. Hilmas, J. Watts, M. C. Leu, Z. Ma, P. Davenport and T. Held).
130. “Additive Manufacturing of Advanced Ceramics,” awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$201,832, 11/27/19-8/31/20 (PI: G. E. Hilmas, Co-PIs: M. C. Leu, J. Watts).
131. “Hybrid 5-Axis Printing and Post-Processing of Carbon Fiber Composites,” awarded by Missouri S&T’s CAMT Industrial Consortium, \$50,000, 1/1/20-12/31/20 (PI: X. Dong, Co-PI: M. C. Leu).
132. “Planning Grant: Engineering Research Center for Integrative Manufacturing and Remanufacturing Technologies (iMart) to Spur Rural Development,” awarded by the National Science Foundation, \$100,000, 9/1/19-8/31/20 (PI: F. Liou, Co-PIs: S. Das, F. Dogan, J. Kimball, M. C. Leu, S. Long, J. Newkirk, H. Peng, J. Sarangapani, S. Sedighsarvestani).
133. “Data analytics for Additive Manufacturing,” funded by Clean Energy Smart Manufacturing Innovation Institute (CESMII), subcontract from Honeywell Aerospace), \$90,950, 12/2/19-12/31/20 (PI: M. C. Leu, Co-PI: J. Huang).

134. "Additive Materials Evaluations," awarded by the National Security Campus of the Department of Energy (operated by Honeywell Federal Manufacturing & Technology), \$120,000, 2/19/20-8/31/20 (PI: M. C. Leu).