

Resume - **R. Bruce Madigan PhD, PE**

Education

1994 PhD, Colorado School of Mines, Metallurgical and Materials Engineering
1985 MS, Ohio State University, Welding Engineering
1983 BS, Ohio State University, Welding Engineering
1979 Certificate, Hobart School of Welding Technology

Academic Experience

2020-present: Emeritus Professor, Montana Technological University
2011-2018: Department Head, General Engineering Department, Montana Technological University
2013-present: Full Professor
2005-2013: Associate Professor
2008: Tenured
2003-2005 Assistant Professor

Teaching Coursework: Practical Welding Lab, Intro to Welding Engineering, Welding Process Applications, Design of Welded Connections, Physics of Welding, Robotic and Automated Welding, Nondestructive Evaluation, Metallurgy of Welds
Graduate Student Completions - 19 MS students, 4 PhD students

Non-academic Experience

2022 – present: Gray Beards Engineering, Senior Advisor
2002 – present: WeldWorks, Consultant in the Welding, Metallurgy, and Manufacturing Industries
1998 – 2002: WeldWare, Inc., Columbus, OH, President and Chief Technical Officer
1989 – 1998: National Institute of Standards and Technology (NIST), Boulder, CO, Research Engineer
1985 – 1989: Edison Welding Institute (EWI), Columbus, OH, Research Engineer
1984 summer: Sandia National Lab, Livermore, CA, Co-op Engineering Intern
1983 – 1985: Ohio State University, Columbus, OH, Research Associate, Welding Engineering Dept.
1983 – 1985: Sensotec, Inc., Columbus, OH, Welding Engineer
1979 – 1980: Klaas Machine and Manufacturing Company, Cleveland, OH, Welder/Fabricator

Professional Registrations

Professional Engineer, State of Ohio, PE52864, 1989 - Present.
Professional Welding Engineer, International Institute of Welding, 2002-present

Professional Memberships

ASM Welding Handbook, Arc Welding Section Editor, 2008.
Vice Chairman, American Welding Society, Montana Section. 2004-2020.
Member, American Welding Society. 1983 – Present.

Professional Honors and Awards

American Welding Society (AWS) Adams Memorial Membership Award, 2023.
American Welding Society (AWS) Plummer Memorial National Educator Award, 2010.
AWS Howard E. Adkins Memorial Instructor Award, 2006.
United States Patents: 11 granted

Service Activities

AWS, Vice Chairman, Montana Section. 2004-2018.

Principal Reviewer, Welding Journal Technical Paper Peer Review Committee. 1989 – 2017.

Professional Development Activities

- Research proposal development and project management
- Continuing education activities for maintaining PE license
- Professional Expert Witness for welding and joining, metallurgical and manufacturing casework
- Subject Matter Expert covering welding and joining processes, process sensing and control, welding metallurgy, thermal heat treatment, procedure selection, development and application, materials characterization including microstructure analysis, and processing equipment design

Patents

Systems and Methods for Additive Manufacturing Operations. Vivek R. Dave, Mark J. Cola, R. Bruce Madigan, Alberto M. Castro, Lars Jacquemetton, and Peter Campbell. Patent number: 11674904. June 13, 2023.

Method and System For Monitoring Additive Manufacturing Processes. Vivek R. Dave, R. Bruce Madigan, Mark J. Cola, and Martin Piltch. Patent Number 11607875. March 21, 2023.

Systems and Methods For Measuring Radiated Thermal Energy During An Additive Manufacturing Operation. R. Bruce Madigan, Lars Jacquemetton, Glenn Wikle, Mark J. Cola, Vivek R. Dave, Darren Beckett, Alberto M. Castro. Patent Number 11390035. July 19, 2022.

Photodetector Array For Additive Manufacturing Operations. R. Bruce Madigan, Mark J. Cola, Scott Betts, Darren Beckett, Alberto M. Castro, Lars Jacquemetton, Martin Piltch. Patent number 11260456. March 1, 2022.

Method And System For Monitoring Additive Manufacturing Processes. Vivek R. Dave, R. Bruce Madigan, Mark J. Cola, Martin S. Piltch. Patent Number 11135654. October 5, 2021.

Optical Manufacturing Process Sensing And Status Indication System. Vivek R. Dave, Mark J. Cola, R. Bruce Madigan, Martin S. Piltch, Alberto Castro. Patent Number 11073431. July 27, 2021.

Systems And Methods For Additive Manufacturing Operations. Vivek R. Dave, Mark J. Cola, R. Bruce Madigan, Alberto Castro, Glenn Wikle, Lars Jacquemetton, Peter Campbell. Patent number: 10717264. July 21, 2020.

Systems And Methods For Measuring Radiated Thermal Energy During An Additive Manufacturing Operation. R. Bruce Madigan, Lars Jacquemetton, Glenn Wikle, Mark J. Cola, Vivek R. Dave, Darren Beckett, Alberto M. Castro. Patent Number 10479020. November 19, 2019

Sensing Arc Welding Process Characteristics For Welding Process Control. Timothy P. Quinn, R. Bruce Madigan. Patent Number 5756967. May 26, 1998.

Prevention of Contact Tube Melting in Arc Welding. Thomas A. Siewert, R. Bruce Madigan, Timothy P. Quinn. Patent Number 5514851. May 7, 1996.

Sensing of Gas Metal Arc Welding Process Characteristics for Welding Process Control. R. Bruce Madigan, Timothy P. Quinn. Patent Number 5349156. September 20, 1994.

Publications and Presentations

Process Mapping Software for Metal Additive Manufacturing – A Gateway to Closed Loop Melt Pool Quality & Process Control. Liquid Propulsion Subcommittee, Advance Materials Panel, Joint Army-Navy-NASA-Air Force (JANNAF). Jackson Center, Huntsville, Alabama. August 2018.

Digital Process Control System Software for Metal Additive Manufacturing with Aerospace Alloys. Mark Cola, Darren Beckett, Lars Jacquemetton, Scotts Betts, R. Bruce Madigan. 45th Annual Review of Progress in Quantitative Nondestructive Evaluation, Burlington, Vermont. July 2018.

Effect of Laser Scan Strategy and Post Processing on High Strain Rate Deformation Response of Additively Manufactured Stainless Steel. Brandon McWilliams, Brahmananda Pramanik, Andelle Kudzal, Bruce Madigan. TMS 2018 Annual Meeting, Phoenix, Arizona. March 2018.

Influence of Build-angle on Charpy Impact Fracture of Laser Powder Bed 3D-printed Stainless Steel and Aluminum Cast Alloy. Brahmananda Pramanik, Kristofer Kuelper, MD. Salahuddin, Bruce Madigan. TMS 2018 Annual Meeting, Phoenix, Arizona. March 2018.

Optimizing Processing Parameter in Laser Sintering Process by Molecular Dynamics Simulation. B.Deng, D. Hobbs, B. Madigan. TMS 2018 Annual Meeting, Phoenix, Arizona. March 2018.

Processing-Microstructure-Mechanical Property Correlation In AlSi10Mg Parts Produced Using Selective Laser Melting., Edward Stugelmayer, Bryce Abstetar, K.V. Sudhakar, Ronda Coguill, Bruce Madigan. Materials Science and Technology 2017, Pittsburgh, PA. October 2017.

Effect of Build Parameters on Microstructure of SS Additive Manufactured Components, Steven Keckler, P. Rawn, K.V. Sudhakar, B. Madigan. Materials Science & Technology 2017, Pittsburgh, PA. October 2017.

Additive Manufacturing of Stainless Steel and Aluminum Alloy: Processing, Microstructure, and Material Properties. S. Vadiraja, B. Abstetar, P. Rawn, R. Coguill, N. Huft and B. Madigan. Materials Science and Technology Conference 2016. Salt Lake City, UT. October, 2016.

Effects of Strain Rate on the Hot Deformation Behavior and Dynamic Recrystallization in China Low Activation Martensitic Steel. Yuanyuan Fang, Xizhang Chen, Bruce Madigan Hongyan Cao, and Sergey Konovalov. Fusion Engineering and Design, Volume 103, pages 21-30, January, 2016.

Laser welding dissimilar materials of aluminum to steel: an overview. Pengfei Wang, Xizhang Chen, Qihong Pan, Bruce Madigan, Jiangqi Long. The International Journal of Advanced Manufacturing Technology. Volume 87, Issue 9–12, pp 3081–3090. December 2016.

In Process Quality assurance: a Process Monitoring and Inspection Tool for Additive Manufacturing. Vivek R. Dave, Mark J. Cola and R. Bruce Madigan. 22nd Meeting of the International Society of Air-Breathing Engines (ISABE). Phoenix, AZ. October, 2015.

Monte Carlo Simulation and Experimental Measurements of Grain Growth in the Heat Affected Zone of 304 Stainless Steel During Multipass Welding. Xizhang Chen, Xing Chen, Huili Xu, Bruce Madigan, and Yuming Huang. International Journal of Advanced Manufacturing Technology, Volume 80, Issue 5, pp1197-1211, September, 2015.

Investigation of microstructures and residual stresses in laser peened Incoloy 800H weldments . Xizhang Chen, Jingjun Wang, Yuanyuan Fang, Bruce Madigan, Guifang Xu, Jianzhong Zhou. Optics & Laser Technology 57, pp 159–164. April, 2014.

Investigation Of Plasma Arc Welding As A Method For The Additive Manufacturing Of Ti-6al-4v Alloy Components. Joe Stavinoha, Wolf Robotics, Inc. and Bruce Madigan, Montana Tech. Presentation at the American Welding Society Annual Conference, Chicago, IL, November, 2013.

Measurement and Analysis of SHCCT Diagram for CLAM Steel. Yuming Huang, Xizhang Chen, Zheng Shen, Bruce Madigan, Lei Yucheng, Jianzhong Zhou. Journal of Nuclear Materials. Volume 432, Issues 1–3, Pages 460–465, January, 2013.

An Overview of the Welding Technologies of CLAM Steels for Fusion Application. Chen, X.; Huang, Y.; Madigan, B.; Zhou, J. Fusion Engineering and Design, Volume 87, issue 9, p. 1639-1646, September, 2012. (A Top 25 Paper ranked by Science Direct in 2012).

Compatibility of CLAM Steel Weldments with Static LiPb alloy at 550 °C. Chen, X.; Shen, Z.; Li, P.; Madigan, B.; Huang, Y.; Lei, Y.; Huang, Q.; Zhou, J. Fusion Engineering and Design, Volume 87, issue 9 p. 1565-1569, September, 2012.

Measurement and Simulation of Titanium Alloy Deposit Temperature in Electron Beam Additive Manufacturing. Madigan, R. Bruce, Sean F. Riley, Mark J. Cola, Vivek R. Dave, and John E. Talkington. Ninth International Trends in Welding Research Conference, Chicago, Illinois, ASM International, June 4-8, 2012.

Arc Welding Process Control. Daniel A. Hartman, Manufacturing Behavioral Science; George E. Cook, Vanderbilt University; R. Bruce Madigan, Montana Tech of the University of Montana; David R. DeLapp, Vanderbilt University. ASM Handbook Volume 6A - ASM International, 2011.

Welding Education: Encouraging a Continued Posture of Learning, Plummer Memorial Education Lecture, American Welding Society Annual Conference, Atlanta, Georgia. 2010

What High School Welding Teachers Need to Know About Welding Engineering. Annual Utah Vocational Teachers Conference. Salt Lake City Utah. June, 2008.

Control of Normal Tool Stress During Friction Stir Welding, R. B. Madigan, B.J. Shubert, and Y. Mao, Montana Tech of the University of Montana and T. J. Lienert, Los Alamos National Lab. American Welding Society Annual Conference, Chicago, IL, November, 2007.

Finite Element Modeling of Friction Stir Welding Mass and Heat Flow, Y. Mao and R.B. Madigan, Montana Tech of the University of Montana and T. J. Lienert, Los Alamos National Lab. American Welding Society Annual Conference, Chicago, IL, November, 2007.

Welding Engineering Curriculum at Montana Tech of the University of Montana, R. B. Madigan. American Welding Society Annual Conference, Chicago, IL, Nov. 2007.

Weldability Tests: The Best Way to Prevent Cracking, R.B. Madigan. American Welding Society Conference, Weld Cracking VI. Las Vegas, NV. October, 2007.

In-Process Monitoring of Friction Stir Welding: A Progress Report, R. B. Madigan. Presented to the Materials Science and Technology Division, Los Alamos National Lab. June, 2007.

Numerical Modeling of Friction Stir Welding , R.B. Madigan, Y. Mao, J. D. Brooke , and R.P. Donovan, Montana Tech, and D.A. Hartman, M.J. Cola, M.Q. Johnson and T.J. Lienert, Los Alamos National Laboratory. National Nuclear Security Agency, Future Technologies Conference II, Regency Capital Hill, Washington DC, 2006.

Manufacturing Curriculum Development at Montana Tech: Extreme Programming Practices Applied to Small-Lot Manufacturing, by B. Madigan and R Donovan, Small-Lot Intelligent Manufacturing Workshop II Sponsored by Los Alamos National Laboratory. Bishop's Lodge, Santa Fe, New Mexico. September, 2005.

The Future of Welding Automation. R. Bruce Madigan. Invited Speaker, Advanced Weapons Engineering and Manufacturing Directorate. Los Alamos National Laboratory. June 2005.

What's New at Montana Tech's Welding Engineering Option, R. Bruce Madigan, Montana Tech. American Welding Society's Education Engineering Committee, What's New in Welding Education? Seminar At The Colorado School of Mines. June 2005.

Achieving Grain Refinement through Mechanical Weld Pool Oscillation. Timothy J. McInerney and R. Bruce Madigan, Montana Tech and C.E. Cross, Federal Institute for Materials Research and Testing (BAM), Joining Technology Division, Berlin, Germany. ASM 7th International Trends in Welding Research Conference, Pine Mountain, GA. May 16-20, 2005.

An Overview of Sensors and Controls for Welding. R. Bruce Madigan, Montana Tech. Presenter and Co-Chairman, AWS Conference on Welding Automation, Dallas, TX. April 27, 2005.

An Overview of Formal Weldability Testing. R. Bruce Madigan, Montana Tech and Carl E. Cross, Federal Institute for Materials Research and Testing (BAM), Joining Technology Division, Berlin, Germany. AWS Weld Cracking V Conference, New Orleans, LA. February 15-16, 2005.

Through-arc process monitoring: techniques for control of automated gas metal arc welding. Barborak, D.; Conrardy, C.; Madigan, B.; Paskell, T. ,IEEE International Conference on Robotics and Automation, Proceedings. Volume 4, Page(s):3053 - 3058 vol.4, 1999.

Arc Sensing for Defects in Constant-Voltage Gas Metal Arc Welding. T. P. Quinn, C. Smith, C. N. McCowan, E. Blachowiak and R. B. Madigan. Welding Journal. September 1999.

Electrode Extension In Aluminum Gas Metal Arc Welding. Quinn, T.P. and Madigan, R.B., AWS Annual Conference. San Diego, CA. April 1997.

Analysis Of The Start Transient In Steel GMAW For Arc Start Control. Madigan, R.B., and Quinn, T.P. AWS Annual Conference. San Diego, CA. April 1997.

Sensing Of Contact Tube Wear In Short Welds. Madigan, R.B., Quinn, T.P. and Klein, C.F. Seventh International Conference on Computer Technology in Welding. San Francisco, CA. July 1997.

Weld Defect Decisions Using Through-The-Arc Sensor Data. Quinn, T.P., Madigan, R.B., Smith, C.B., and Blachowiak, E.G. Seventh International Conference on Computer Technology in Welding. San Francisco, CA. July 1997

A Standard Procedure For Spatter Measurement. McCowan, C.N., Madigan, R.B., Siewert, T.A., and Dube, W.P. AWS Annual Conference. Chicago, IL. April, 1996.

Survey Of Welding Arc Optical Emissions For Process Control. Richardson, R.W. and Madigan, R. B. AWS Annual Conference. Chicago, IL. April 1996.

Power Characteristics In GMAW; Experimental And Numerical Investigations. Jonsson, P.G., Szekely, J., Madigan, R.B., and Quinn, T.P. Welding Journal. March 1995.

Contact Tip Wear Detection In Gas Metal Arc Welding. Madigan, R.B., Quinn, T.P., Mornis, M.A., and Siewert, T.A. Welding Journal. April 1995.

Sensing And Control Of Droplet Frequency During GMAW. Madigan, R.B. AWS Annual Conference. Cleveland, OH. April 1995.

A Review Of NIST Workshop On Welding Industry Needs. Naval Ship Panel 7 Meeting. AWS Precision Joining Center. Denver, CO. August, '95.

Control Of Gas-Metal-Arc Welding Using Arc Light Sensing. Madigan, R.B., Quinn, T.P., and Siewert, T.A. NISTIR 5037. November 1995.

Computers in Welding: A Primer. Siewert, T.A., Madigan, R.B. and Quinn, T.P. Welding Journal. February 1994.

Mapping The Droplet Transfer Modes For An ER100S-1 GMAW Electrode. Heald, P.R., Madigan, R.B., Siewert, T.A. and Liu, S. Welding Journal. February 1994.

Adaptive control of arc length during gas metal arc welding. Madigan, R.B. and Quinn, T.P. AWS International Conference. Philadelphia, Pennsylvania. April 1994.

Graphical User Interfaces for Monitoring and Controlling GMAW. Madigan, R.B., Sloan, C., Quinn, T.P., and Siewert, T.A. Fifth International Welding Computerization Conference. Golden, CO. August 1994.

An electrode extension model for gas metal arc welding. Quinn, T.P., Madigan, R.B., and Siewert, T.A. *Welding Journal*. October 1994.

Control of arc length during gas metal arc welding. Madigan, R.B. and Quinn, T.P. AWS International Conference on Modelling and Control of Joining Processes. Orlando, Florida. December 1993.

Arc length controller design for GMAW. Quinn, T.P. and Madigan, R.B. AWS International Conference on Modelling and Control of Joining Processes. Orlando, Florida. December 1993.

Detection of wear in contact tubes for GMAW. Quinn, T.P., Madigan, R.B., and Siewert, T.A. *Proceeding of the 1993 ASME Symposia on Manufacturing Science and Engineering*. New Orleans, LA.

Dynamic model of electrode extension for gas metal arc welding. T.P. Quinn and R.B. Madigan, *International Trends in Welding Science and Technology*, ASM International Conference Proceedings pp. 1003-1008, Gatlinburg, Tennessee, June, 1992.

Sensing droplet detachment and electrode extension for gas metal arc welding. R.B. Madigan, T.P. Quinn and T.A. Siewert. *International Trends in Welding Science and Technology*. ASM International Conference Proceedings. pp. 999-1002. Gatlinburg, Tennessee. June 1992.

Through-the-arc sensing for monitoring arc welding. T.A. Siewert, R.B. Madigan and T.P. Quinn. *International Trends in Welding Science and Technology*. ASM International Conference Proceedings. pp. 1037-1040. Gatlinburg, Tennessee. June 1992.

Through-the-arc sensing for real-time measurement of gas metal arc weld quality. T.A. Siewert, R.B. Madigan and T.P. Quinn. *International Conference on Computerization of Welding Information IV*. pp. 198-206. American Welding Society. November 1992.

Through-the-arc sensing for measuring gas metal arc weld quality in real time. T.A. Siewert, R.B. Madigan and T.P. Quinn. *Materials Evaluation*. pp. 1314-1318. November 1992.

Evaluation of alternative sensors for control of GMAW. Madigan, R.B., Quinn, T.P., Siewert, T.A., Liu, S. and Jones, J.E. AWS Annual Conference. Detroit, MI. April 1991.

Investigation of spray transfer parameters in GMAW. Heald, P.R., Liu, S., Madigan, R.B., and Siewert, T.A. American Welding Society Annual Conference. Detroit, MI. April 1991.

Droplet transfer modes for a MIL 100S-1 GMAW Electrode. Heald, P.R., Madigan, R.B., Siewert, T.A., and Liu, S. NISTIR 3976. United States Department of Commerce. National Institute for Standards and Technology. Materials Reliability Division. October 1991.

Gas tungsten arc welding. AWS Welding Handbook, 8th Edition, Vol 2, Chapter 3. Hicken, G.K., Campbell, R.D., Daumeyer, G.J., Madigan, R.B., Marburger, S.J. and Young, B. American Welding Society, 1991.

Survey of penetration control techniques. Madigan, R.B. and Castner, H.R. Edison Welding Institute Research Report MR9002, January 1990.

PC-based expert systems and their applications to welding. Barborak, D.M., Dickinson, D.W. and Madigan, R.B. Welding Journal. January 1990. pp. 29-38.

Review of welding process controls. Madigan, R. B. Golden Gate Materials Technology Conference. San Francisco, CA. 1989.

Process modeling and control. Madigan, R.B. Second Annual North American Welding Research Seminar. EWI/TWI. Columbus, Ohio. September 1988.

How to control weld penetration. Madigan, R.B. Welding Design & Fabrication. September 1987.

Ways to keep torches in seams. Madigan, R.B. Welding Design & Fabrication. October 1987.

Coaxial vision for control of welding Al and Ti plate. Richardson, R.W., and Madigan, R.B. American Welding Society Annual Conference. 1987.

Control of full-penetration GTA welds using pool oscillation sensing. Madigan, R.B. and Richardson, R.W. American Welding Society Annual Conference. 1986.

Computer-based control of full penetration GTA welds using pool oscillation sensing. Madigan, R.B., Renwick, R.J., Farson, D.F., and Richardson, R.W. International Conference on Computer Technology In Welding, Paper 11. The Welding Institute. London, England. 1986.

Control of full-penetration GTA weld size in sheet metal using weld pool oscillation sensing. Madigan, R. B. and Richardson, R.W. Sheet Metal Welding Conference II. Paper 9. Dearborn, Michigan. 1986.