

# Jeffrey A. Abell, Ph.D., FSME, PE

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## PROFESSIONAL EXPERIENCE

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### General Motors Company, Warren, MI

2018-present Director, Manufacturing Systems Research, Global Research & Development

Chief Scientist for Global Manufacturing: Responsible for corporate manufacturing research, dual reporting to CTO / VP R&D and VP Global Manufacturing Engineering

Executive responsibility for corporate manufacturing research strategy and initiatives in alignment with Manufacturing Engineering technology governance

Primary areas of research responsibility include electrification, lightweight processing, automation, additive manufacturing, and smart manufacturing

Represent General Motor's manufacturing corporate research interests

USCAR – member of Manufacturing Technical Leadership Council

General Motors / UM Collaborative Research Lab – Advanced Vehicle Manufacturing – co-Director

MForesight – member of Leadership Council

2008 – 2018 GM Technical Fellow and Lab Group Manager, Manufacturing Systems Research Lab, GM R&D

Responsible for corporate advanced battery manufacturing research activities

Manage team of 10 full-time researchers and associated support resources to invent and implement innovative technology for advanced battery production to enable product and address manufacturability issues.

Implemented first-in-industry technologies: ultrasonic weld process monitoring system (2010 GM Volt); reconfigurable battery assembly system (2016 eAssist)

Co-Director, General Motors and University of Michigan Collaborative Research Lab – Advanced Vehicle Manufacturing

Developed and implemented strategic, cross-functional research and advanced ME roadmap leading to collaborative development between R&D and engineering groups for advanced battery manufacturing successfully since 2009

Responsible for average annual research budget of \$1.5M and staff including researchers, engineers, and technicians

Manage corporate Technology Strategic Risk activity and Manufacturing Technology Key Technology Area Strategy.

- 2006 – 2008 Technical Manager, Robust Synthesis, Global CAx Methods and Integration  
 Directed development and integration of statistical, optimization, and analytical methods for engineering decision and analysis tools  
 Technical areas included metal forming analysis (20x improvement), vehicle electrical architecture analysis, engine and driveline controls analysis, and engineering business decision support
- 2003 – 2006 Manager, Global Engineering Integration (International Service Personnel assignment, Adam Opel, AG, Rüsselsheim, Germany)  
 Reorganized and led global team responsible for Global Key Characteristic Description System / Key Product Characteristic (KCDS/KPC) content alignment global vehicle architecture  
 Directed Global Design Engineer single point product release team and defined engineering processes for global, single point product release in coordination with change management, BOM & Reuse, and design operations teams  
 Developed total vehicle mass potential genetic optimization program that maximizes overall mass savings and minimizes front axle load reduction within cost constraints
- 2002 – 2003 Engineering Group Manager – Vehicle Development Process Engineering, Engineering Process & Math Strategy Group  
 Managed a team of eight engineers to deliver strategic engineering process reengineering projects (GVDP based reengineering)  
 Developed and implemented standard work process for Global Integrated Assessment Review process
- 2001 – 2002 Engineering Group Manager – Program Implementation, Engineering Process & Math Strategy  
 Integrated teams from both Car and Truck engineering organizations into single group of 15 total engineers  
 Developed and implemented Program Math Workshop and Math Plan process, including Master Program Implementation Plan for implementation of math-based-process methods and initiatives for approximately 30 vehicle programs.
- 2000 – 2000 Engineering Group Manager - Pontiac Math Implementation, Math Data Strategies  
 Reorganized and managed team of eight engineers responsible for:  
 Design Analysis Process implementation at Pontiac Truck Engineering site  
 Pontiac Supplier Math Collaboration Activities  
 Managed installation & implementation of Pontiac Virtual Reality Center

**DaimlerChrysler Corporation, Advance Manufacturing Engineering, Auburn Hills, MI**

1998 – 2000 Senior Systems Specialist, Manufacturing Technical Support

Managed Manufacturing Simulation & Analysis development group – responsible for robotic and throughput simulation development; robotic systems activity (robot testing, in-line inspection)

Directed evaluation and development projects in support of recommendations executive management regarding digital manufacturing tools & systems

Directed Virtual Manufacturing Post-Merger Integration (PMI) Projects

**Delphi Interior & Lighting Systems, General Motors Corporation, Troy, MI**

1994 – 1998 Advanced Manufacturing Engineer, Advanced Development Group

Developed and implemented advanced manufacturing engineering technologies for design, simulation, and analysis of manufacturing processes

Managed Virtual Factory Laboratory (project manager, lead subject matter expert)

Managed Virtual Factory Center Of Expertise, Delphi Automotive Systems

Principal Investigator, “Virtual Factory”, Cooperative Research And Development Agreement with U.S. Army TARDEC and Deneb Robotics, 7/96-11/98

**SA Consulting, Novi, MI**

1992 – 1994 Senior Consultant

Developed user interface and responsible for database integration for manufacturing plant scheduling system (implemented at Ford Sandusky, OH operations)

**GMI Engineering & Management Institute, Flint, MI**

1985 – 1994 Assistant Professor – Industrial & Mfg. Systems Engineering

Instructor, Instructional Assistant – Mechanical Engineering

See Academic and Teaching Experience

**Inland Division, General Motors Corporation, Dayton, OH**

1985 Associate Manufacturing Engineer, Manufacturing Development Laboratory

Responsible for process, equipment, and tool development for molded instrument panels

1980 - 1985 GMI Cooperative Education Student

Engineering coop student (9 semesters) – product engineering, manufacturing engineering, manufacturing operations, business operations

Completed Bachelor's thesis at Inland's Portugal manufacturing

## ACADEMIC AND TEACHING EXPERIENCE

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### Full-time faculty experience

1985 - 1994 Assistant Professor, GMI Engineering & Management Institute, Industrial & Manufacturing Systems Engineering

Taught in both Mechanical Engineering and Manufacturing Engineering programs

Member: Academic Review and Retention Committee, Special Policy Committee on Sexual Harassment, and GMI Research Council

Chair, Industrial and Manufacturing Systems Engineering department head search committee

Directed thesis work for 52 bachelor's degree and one master's degree students

Increased in rank and responsibility (Instructional Assistant, Instructor, Assistant Professor) – completed graduate studies while full-time faculty

### Adjunct faculty experience

1999 Manufacturing Optimization, Lawrence Technological University

1997/1998 Automated Production Systems, Lawrence Technological University

1995 Simulation, Wayne State University

### Academic contributions - professional development

2005 – 2006 Developed and delivered training to 200 engineers; managed GMNA and GME pilot case studies (international work assignment, GM - Opel, Germany)

1993 - 1994 Fundamentals of Manufacturing Review and Manufacturing Engineering Certification Review (Part II) - short course taught for Society of Manufacturing Engineers

### Doctoral committees

2015 Chenhui Shao, University of Michigan

2012 Sha Li, University of Michigan

2011 Karthik Manohar, Stanford University

2008 April Bryan, University of Michigan

2006 Peter Leung, Stanford University

## EDUCATION

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1992 **Doctor of Philosophy**, Systems Engineering, Oakland University, Rochester, MI

1987 **Master of Science**, Systems Engineering, Oakland University, Rochester, MI

1985 **Bachelor of Science**, Mechanical Engineering, Kettering University (formerly General Motors Institute), Flint, MI

## **SPONSORED RESEARCH**

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- 2013-2016 Co-Principal Investigator, NSF Grant – “GOALI/Collaborative Research: Module-Centric Approach to Integrated Adaptation of Assembly Products and Supply Chains” (CMMI- 1331633), \$142,323
- 2011-2013 Co-Principal Investigator, NSF Grant – “GOALI/Collaborative Research: Module-Centric Approach to Integrated Adaptation of Assembly Products and Supply Chains” (CMMI-1100960), \$202,770
- 2009-2014 DOE Grant - “GM Li-ion Battery Pack Manufacturing”, (ARRAVT0005), Managed engineering activities funded with approx. \$14M from grant (\$105M total grant)
- 2008-2013 Co-Principal Investigator, NSF Grant – “GOALI: Biogeography-Based Optimization of Multiple Related Complex Systems” (CMMI-0826124), \$539,467
- 2008-2009 Co-Principal Investigator, NSF Grant – “GOALI: Modeling Product Variety Induced Manufacturing Complexity for Assembly System Design” (CMMI-0825438), \$349,767
- 1994-1996 Co-Principal Investigator, NSF Grant - “Flexible Assembly Cell” (DUE-9451778), \$45,000

## **INTELLECTUAL PROPERTY**

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### **Patents (multiple inventors)**

- System and method for determining a position for an addendum mesh node (US 8,325,183 B2)
- Ultrasonic welding system with dynamic pressure control (US 8,439,247 B1)
- Systems and methods for joining wires of a motor stator (US 8,499,438 B2)
- Vibration welding system with thin film sensor (US 8,672,211 B2)
- Method and system for online quality monitoring and control of a vibration welding process (US 8,702,882 B2)
- Binary classification of items of interest in a repeatable process (US 8,757,469 B2)
- Automatic monitoring of vibration welding equipment (US 8,858,742 B2)
- Binary classification of items of interest in a repeatable process (US 8,925,791 B2)
- Method and system for online quality monitoring and control of a vibration welding process (US 9,120,186 B2)
- Conductive adhesive and method of forming same (US 9,446,539 B2)
- Systems and methods for adaptive process control using a target kinematics profile in welding together multiple polymeric workpieces (US 9,550,323 B2)
- System and method for controlling a vision guided robot assembly (US 9,586,320 B2)

Quality status display for a vibration welding process (US 9,604,305 B2)

### **Trade Secrets, Defensive Publications**

Eight TMS classified inventions, one defensive publication

### **JOURNAL PUBLICATIONS**

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- Abell, Jeffrey A., Debejyo Chakraborty, Carlos A. Escobar, Kee H. Im, Diana M. Wegner and Michael A. Wincek 2017. Big Data Driven Manufacturing --- Process-Monitoring-for-Quality Philosophy, ASME Journal of Manufacturing Science and Engineering (JMSE) on Data Science-Enhanced Manufacturing, 139 (10).
- Xi L, Banu M, Hu S. Jack, Cai W, Abell J. 2016. Performance Prediction for Ultrasonically Welded Dissimilar Materials Joints. ASME. J. Manuf. Sci. Eng.;139(1):011008-011008-13. doi:10.1115/1.4033692.
- Lee, S.S., T.H. Kim, W. Cai, J.A. Abell 2014. "Parasitic vibration attenuation in ultrasonic welding of battery tabs", The International Journal of Advanced Manufacturing Technology, Volume 71, Issue 1-4, 181-195.
- Shao, C., K. Paynabar, T.H. Kim, J. Jin, S.J. Hu, J.P. Spicer, H. Wang, J.A. Abell 2013. "Feature selection for manufacturing process monitoring using cross-validation", Journal of Manufacturing Systems, Volume 32, Issue 4, 550-555.
- Li, H., H. Choi, C. Ma, J. Zhao, H. Jiang, W. Cai, J.A. Abell, X. Li 2013. "Transient Temperature and Heat Flux Measurement in Ultrasonic Joining of Battery Tabs Using Thin-Film Microsensors", Journal of Manufacturing Science and Engineering, Volume 135, Number 5.
- Bryan, A., H. Wang, J. Abell 2013. "Concurrent Design of Product Families and Reconfigurable Assembly Systems", Journal of Manufacturing Science and Engineering, Volume 135, Number 5.
- Zhao, J., H. Li, H. Choi, W. Cai, J.A. Abell, X. Li 2013. "Insertable thin film thermocouples for in situ transient temperature monitoring in ultrasonic metal welding of battery tabs", Journal of Manufacturing Processes, Volume 15, Issue 1, 136-140.
- Lee, S.S., T.H. Kim, S.J. Hu, W. Cai, J.A. Abell 2013. J. Li, "Characterization of Joint Quality in Ultrasonic Welding of Battery Tabs", Journal of Manufacturing Science and Engineering, Volume 135, Number 2.
- Shin J., Spicer J.P., Abell J.A. 2012. "Inverse and direct magnetic shaping problems", Structural Multidisciplinary Optimization, Volume 46, Number 2, 285-301.
- Li, S., H. Wang, Y.T. Lin, J. Abell, and S.J. Hu 2011. "Automatic Generation of Assembly System Configuration with Equipment Selection for Automotive Battery Manufacturing", Journal of Manufacturing Systems, Volume 30, Issue 4, 188-195.
- Kim, T.H., S.J. Hu, J.A. Abell, J.P. Spicer 2011. "Process Robustness of Single Lap Ultrasonic Welding of Thin, Dissimilar Material", CIRP Annals, Vol. 60, No. 1, 17-20.
- Simon, D., and J. Abell 2010. "A Majorization Algorithm for Constrained Correlation Matrix Approximation", Linear Algebra and its Applications (Elsevier) Vol. 432, 1152-1164.
- Leung, P., K. Ishii, J. Abell, and J. Benson 2008. "Distributed System Development Risk Analysis", Journal of Mechanical Design, 130 (5), pp.051403 (1-11).

Sefferdini, Hamid, A.D. Castillo, and J.A. Abell 1997. "The Development of Cellular Manufacturing System for Automotive Parts", Computers & Industrial Engineering, Volume 33, pp. 243-247.

Abell, J.A. and R.P. Judd 1993. "Perturbation Analysis of Structurally Modified Discrete Event Systems", Transactions of the Society for Computer Simulation, vol. 10, pp. 185-204.

## **BOOKS AND CHAPTERS**

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Multiple chapters (with co-authors) in Ultrasonic Welding of Lithium-Ion Batteries (eds W. Cai, B. Kang and S.J. Hu), ASME Press, ISBN: 9780791861257 (2017).

## **CONFERENCE PUBLICATIONS (refereed conferences indicated)**

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Lee, S.S., T.H. Kim, S.J. Hu, W. Cai, J.A. Abell, J. Li, "Characterization of ultrasonic metal weld quality for lithium-ion battery tab joining", Proceedings of ASME Manufacturing Science and Engineering Conference, 2012 (refereed).

Li, S., H. Wang, Y.T. Lin, J. Abell, S.J. Hu, "Benchmarking of high capacity battery module/pack design for automatic assembly system", Proceedings of the 2010 ASME International Manufacturing Science and Engineering Conference, October 2010 (refereed).

Lee, S., T.H. Kim, S.J. Hu, W. Cai, J. Abell, "Joining Technologies for Automotive Lithium-Ion Battery Manufacturing - A Review", Proceedings of the 2010 ASME International Manufacturing Science and Engineering Conference, October 2010 (refereed).

Manohar, K., J. Abell, K. Beiter, D. Gonzales, "Analytical Framework to Define Product Architecture", Proceedings of the 2010 ASME Design Engineering Technical Conference, DETC2010-2916, August 2010 (refereed).

Abell, J., and D. Du, "A Framework for Multiobjective, Biogeography Based Optimization of Complex System Families", Proceedings of the 13th AIAA Multidisciplinary Analysis and Optimization Conference, Fort Worth, Texas, September, 2010.

Kanajan, S., and J. Abell, "Sensitivity Analysis on Flexray Dynamic Segment Design Parameters", Fourth International Conference on Systems and Networks Communications, Porto, Portugal, September, 2009 (refereed, Best Paper Award).

Leung, P., K. Ishii, J. Benson, and J. Abell, "Validation of Distributed Risk Framework", 2007 ASME Design Engineering Technical Conference (DETC2007-34868, refereed), Las Vegas, NV, September, 2007.

Leung, P., K. Ishii, J. Benson, and J. Abell, "Distributed Component Risk Analysis", Proceedings of ASME International Mechanical Engineering Congress and Exposition '06 (IMECE2006-14131), Chicago, IL, November, 2006 (refereed).

Leung, P., K. Ishii, J. Benson, and J. Abell, "System Engineering Workshare Analysis", Proceedings of the 2006 ASME Design Engineering Technical Conference (DETC2006-99252), Philadelphia, PA, September, 2006 (refereed).

Leung, P., K. Ishii, J. Abell, and J. Benson, "Global Failure Modes and Effects Analysis: A Planning Tool for Global Product Development," Proceedings of the 2005 ASME Design Engineering Technical Conference (DETC2005-85117), Long Beach, CA, September, 2005 (refereed).

- VandenBossche, D.J. and J.A. Abell, "Using Visualization and Simulation Tools for Improved Equipment Reliability and Maintainability", SAE 11th RMSL Workshop, May 1999.
- Donald, D., N. Andreou, J. Abell, R. Schreiber, "The New Design: The Changing Role of Industrial Engineers in the Design Process through the use of Simulation", Proceedings of 1999 Winter Simulation Conference, December, 829-833.
- Abell, J.A., "Generative Part Sequence Optimization for an m-Machine Workcell", Proceedings of Autofact '98, Society of Manufacturing Engineers, October.
- Abell, J.A., "Design and Validation of Manufacturing Control Schemes Using an Integrated PC Based System Simulation", Proceedings of the First World Congress on System Simulation, September 1997, Singapore.
- Sefferdini, Hamid, A.D. Castillo, and J.A. Abell, "The Development of Cellular Manufacturing System for Automotive Parts: A Case Study", Proceedings of the 1997 Industrial Engineering Research Conference, March, Puerto Rico (refereed).
- Judd, R.P. and J.A. Abell, "The Use of Simulation for Off-Line Controller Validation", Proceedings of the 1996 Summer Computer Simulation Conference, Portland, OR, July, 92-96.
- Abell, J.A. and J.P. Pullukat, "Fuzzy Modeling of Manufacturing Processes", Proceedings of SPIE International Symposium on Intelligent Systems and Advanced Manufacturing (refereed), Philadelphia, October 1995.
- Wemple, J. and J.A. Abell, "A Model of Material Movement Requirements", Proceedings of 1994 Summer Computer Simulation Conference, La Jolla, CA, July, 607-612.
- King, L.S., J.A. Abell, and W.F. Erevelles, "Hierarchical Control in CIM Education" (invited paper), Proceedings of 1993 Allerton Conference on Control, Champaign, IL, September.
- Abell, J.A. and R.P. Judd, "Perturbation Analysis of Discrete Event System using Aggregated Objects", Proceedings of 1993 Summer Computer Simulation Conference, July, 65-69.
- Abell, J.A. and R.P. Judd, "Perturbation Analysis of Object Oriented Discrete Event Systems", Proceedings of 1993 American Control Conference (refereed), June, 2293-2297.
- Abell, J.A. and R.P. Judd, "Reusable Simulation Object Specification through Arbitrary Message Passing and Aggregation Scheme", Proceedings of 1993 Object Oriented Simulation Conference (OOS '93), January, 9-14.
- Abell, J.A. and R.P. Judd, "Object Oriented Perturbation Analysis of Discrete Event Systems", Proceedings of 1992 Summer Computer Simulation Conference, Reno, Nevada, July, 164-168.
- Abell, J.A. and R.P. Judd, "Model and Algorithm for Analysis of Discrete Event Systems with Structural Changes", Proceedings of 1992 American Control Conference (refereed), Chicago, June, 3206-3210.
- Abell, J.A. and R.P. Judd, "Perturbation Analysis for Systems with Large Structural Changes", Proceedings of 1991 Summer Computer Simulation Conference, Baltimore, July, 104-109.

## **INVITED TALKS AND PANELS**

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- "Research Challenges in Manufacturing Systems and control: the road to Smart Manufacturing", December 5, 2018 (for University of Illinois, Mechanical Science & Engineering seminar) and November 16, 2018, University of Michigan, Industrial, Operations, and Systems Engineering seminar)
- "Lean transformation through innovative research", November 16, 2018, Lean Management Institute, Oakland University



- “Next Gen Quality”, Keynote address, 2016 IEOM Conference, Southfield, MI, September 23, 2016.
- “High fidelity Process Monitoring of Ultrasonically Welded Battery Tabs”, invited talk, University of Wisconsin – Madison, Department of Industrial and Systems Engineering, Dec 3, 2014.
- “High Volume Battery Pack Manufacturing”, invited panel presentation, Symposium on Manufacturing Research towards Sustainable Transportation, 2011 ASME Manufacturing Science and Engineering Conference, Portland, June 2011.
- “Li-ion Battery Pack Manufacturing”, 2010 Green Energy Manufacturing Workshop, University of Michigan – Ann Arbor, October 2010.
- “Robust Architectures”, Stanford MML Supply Chain Forum (Palo Alto, CA), July 2007.
- “Management of Global Partnerships”, Stanford MML Supply Chain Forum (Palo Alto, CA), July, 2006.
- “Confidence in Workshare Planning”, EPFL-Stanford International Research Roundtable (Lausanne, Switzerland), Sept., 2004.

## LICENSURE AND CERTIFICATES

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- 2016 Harvard Business School - GM Emerging Leader II certification  
 1997 Professional Engineer (Michigan), No. 6201043878  
 1991 Certified Manufacturing Engineer (CMfgE / SME), No. 2655884

## PROFESSIONAL SERVICE

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### **ABET** (formerly Accreditation Board for Engineering and Technology)

- |                |   |
|----------------|---|
| 2015 - present | Industrial Advisory Council (Vice-Chair 2018-present)                             |
| 2014 - present | Commissioner, Engineering Accreditation Commission (EAC)                          |
| 2009 - 2013    | Alternate Commissioner, Engineering Accreditation Commission                      |
| 2007 - present | Program Evaluator, Manufacturing Engineering (SME), Mechanical Engineering (ASME) |

### **SME** (formerly Society of Manufacturing Engineers)

- |                |   |
|----------------|---|
| 2016 - present | Member, International Awards Review Committee           |
| 2010 – present | Education and Accreditation Committee (Chair 2012-2018) |
| 2011           | Member, Certification Oversight & Appeals Committee     |
| 1998 - 2003    | Member, Professional Licensure committee                |

### **SCS** (formerly Society for Computer Simulation)

- |             |   |
|-------------|---|
| 2000 - 2002 | Board of Directors  |
| 1998 - 2000 | Vice President - Membership   |
| 1995 - 1997 | Strategic Planning Committee  |
| 2000        | Editor, “Simulation in the Automotive Industry”, special issue of <i>Simulation</i> |

### **Academic Advisory Boards**

- 2018-present Member, Dean's Advisory Council, Kettering University  
2014-present Member, Mechanical Engineering Industrial Advisory Board, Lawrence Technological University  
2000 – 2002 Kettering University Alumni Board

### **NSF**

- 2008 – 2012 NSF Reviewer, CMMI, Engineering Design and Innovation directorate

### **HONORS AND AWARDS**

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- 2016 IEOM Distinguished Industry Award  
2015 College of Fellows, SME  
2011, 2014 GM Boss Kettering Award  
2009 Best Paper, International Academy, Research, and Industry Association  
1980-1985 Tau Beta Pi (National Engineering Honor Society); Management Honor Society (General Motors Institute); Pi Tau Sigma (National Mechanical Engineering Honor Society); Phi Eta Sigma (Freshman Honor Society)

### **CIVIC AND COMMUNITY SERVICE**

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- 2017 – present Chair, Religious Program Committee, Great Lakes Field Service Council, Boy Scouts of America, Detroit, MI  
2015 – present Judges' Foreman, St. John Chrysostom Oratorical Festival, Greek Orthodox Metropolis of Detroit  
2009 – present Chaplain, BSA Troop 360, Auburn Hills, MI  
2010 – present Merit badge counselor, Great Lakes Field Service Council, Boy Scouts of America, Detroit, MI  
2007-2013 Adult leader, BSA Pack 195, University Hills Elementary School, Rochester Hills, MI