

Matthew J. Daigle

Curriculum Vitae

Research Computer Scientist
NASA Ames Research Center
Mail Stop 269-3, Moffett Field, CA 94035

matthew.j.daigle@nasa.gov
<http://www.matthewjdaigle.com>
Phone: (650) 604-4583

EDUCATION

- 2004–2008 Vanderbilt University, Nashville, Tennessee
Ph.D. Computer Science (GPA 4.00/4.00)
Dissertation: “A Qualitative Event-based Approach to Hybrid Systems Diagnosis”
- 2004–2006 Vanderbilt University, Nashville, Tennessee
M.S. Computer Science (GPA 4.00/4.00)
- 2000–2004 Rensselaer Polytechnic Institute, Troy, New York
B.S. Computer and Systems Engineering, Computer Science (GPA 4.00/4.00)

PROFESSIONAL EXPERIENCE

- 2012–Present Research Computer Scientist, Intelligent Systems Division, NASA Ames Research Center
- 2008–2011 Associate Scientist, Intelligent Systems Division, University of California, Santa Cruz, NASA Ames Research Center
- 2004–2008 Research Assistant, Institute for Software Integrated Systems, Electrical Engineering and Computer Science Department, Vanderbilt University

PUBLICATIONS

Publications, if available, can be downloaded from <http://www.matthewjdaigle.com>.

Journal Articles

- [J1] **M. Daigle** and S. Sankararaman, “Predicting Remaining Driving Time and Distance of a Planetary Rover under Uncertainty,” *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part B: Mechanical Engineering*, to appear.
- [J2] **M. Daigle**, A. Bregon, X. Koutsoukos, G. Biswas, and B. Pulido, “A Qualitative Event-based Approach to Multiple Fault Diagnosis in Continuous Systems using Structural Model Decomposition,” *Engineering Applications of Artificial Intelligence*, vol. 53, pp. 190-206, August 2016.
- [J3] C. Kulkarni, G. Gorospe, **M. Daigle**, and K. Goebel, “A Testbed for Implementing Prognostic Methodologies on Cryogenic Propellant Loading Systems,” *IEEE Instrumentation & Measurement Magazine*, vol. 18, no. 4, pp. 5-15, August 2015.
- [J4] **M. Daigle**, I. Roychoudhury, and A. Bregon, “Qualitative Event-based Diagnosis Applied to a Spacecraft Electrical Power Distribution System,” *Control Engineering Practice*, vol. 38, pp. 75-91, May 2015.
- [J5] S. Sankararaman, **M. Daigle**, and K. Goebel, “Uncertainty Quantification in Remaining Useful Life Prediction using First-Order Reliability Methods,” *IEEE Transactions on Reliability*, vol. 63, no. 2, pp. 603-619, June 2014.
- [J6] **M. Daigle**, A. Bregon, and I. Roychoudhury, “Distributed Prognostics Based on Structural Model Decomposition,” *IEEE Transactions on Reliability*, vol. 63, no. 2, pp. 495-510, June 2014.
- [J7] A. Bregon, **M. Daigle**, I. Roychoudhury, G. Biswas, X. Koutsoukos, and B. Pulido, “An Event-based Distributed Diagnosis Framework using Structural Model Decomposition,” *Artificial Intelligence*, vol. 210, pp. 1-35, May 2014.

- [J8] E. Balaban, S. Narasimhan, **M. Daigle**, I. Roychoudhury, A. Sweet, C. Bond, and G. Gorospe, "Development of a Mobile Robot Test Platform and Methods for Validation of Prognostics-Enabled Decision Making Algorithms," *International Journal of Prognostics and Health Management*, vol. 4, no. 1, May 2013.
- [J9] **M. Daigle** and K. Goebel, "Model-based Prognostics with Concurrent Damage Progression Processes," *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, vol. 43, no. 4, pp. 535-546, May 2013.
- [J10] **M. Daigle**, J. Boschee, M. Foygel, and V. Smelyanskiy, "Temperature Stratification in a Cryogenic Fuel Tank," *AIAA Journal of Thermophysics and Heat Transfer*, vol. 27, no. 1, pp. 116-126, January 2013.
- [J11] V. Osipov, **M. Daigle**, C. Muratov, M. Foygel, V. Smelyanskiy, and M. Watson, "Dynamical Model of Rocket Propellant Loading with Liquid Hydrogen," *AIAA Journal of Spacecraft and Rockets*, vol. 48, no. 6, pp. 987-998, November 2011.
- [J12] **M. Daigle** and K. Goebel, "A Model-based Prognostics Approach Applied to Pneumatic Valves," *International Journal of Prognostics and Health Management*, vol. 2, no. 2, August 2011.
- [J13] I. Roychoudhury, **M. Daigle**, G. Biswas, and X. Koutsoukos, "Efficient Simulation of Hybrid Systems: A Hybrid Bond Graph Approach," *Simulation: Transactions of The Society for Modeling and Simulation International*, vol. 87, no. 6, pp. 467-498, June 2011.
- [J14] **M. Daigle**, X. Koutsoukos, and G. Biswas, "An Event-based Approach to Integrated Parametric and Discrete Fault Diagnosis in Hybrid Systems," *Transactions of the Institute of Measurement and Control, Special Issue on Hybrid and Switched Systems*, vol. 32, no. 5, pp. 487-510, October 2010.
- [J15] **M. Daigle**, I. Roychoudhury, G. Biswas, X. Koutsoukos, A. Patterson-Hine, and S. Poll, "A Comprehensive Diagnosis Methodology for Complex Hybrid Systems: A Case Study on Spacecraft Power Distribution Systems," *IEEE Transactions of Systems, Man, and Cybernetics, Part A, Special Section on Model-based Diagnosis: Facing Challenges in Real-world Applications*, vol. 4, no. 5, pp. 917-931, September 2010.
- [J16] A. Moustafa, S. Mahadevan, **M. Daigle**, and G. Biswas, "Structural and Sensor Damage Identification using the Bond Graph Approach," *Structural Control and Health Monitoring*, vol. 17, no. 2, pp. 178-197, March 2010.
- [J17] **M. Daigle**, X. Koutsoukos, and G. Biswas, "A Qualitative Event-based Approach to Continuous Systems Diagnosis," *IEEE Transactions on Control Systems Technology*, vol. 17, no. 4, pp. 780-793, July 2009.
- [J18] I. Roychoudhury, **M. Daigle**, G. Biswas, and X. Koutsoukos, "An Efficient Method for Simulating Complex Systems with Switching Behaviors Using Hybrid Bond Graphs," *Simulation News Europe*, vol. 18, no. 3-4, pp. 5-13, December 2008.
- [J19] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Distributed Diagnosis in Formations of Mobile Robots," *IEEE Transactions on Robotics*, vol. 23, no. 2, pp. 353-369, April 2007.

Refereed Conference Proceedings

- [C1] **M. Daigle**, A. Bregon, and I. Roychoudhury, "A Qualitative Fault Isolation Approach for Parametric and Discrete Faults Using Structural Model Decomposition," *Annual Conference of the Prognostics and Health Management Society 2016*, to appear.
- [C2] **M. Daigle**, S. Sankararaman, and I. Roychoudhury, "System-level Prognostics for the National Airspace," *Annual Conference of the Prognostics and Health Management Society 2016*, to appear.
- [C3] A. Bregon, **M. Daigle**, and I. Roychoudhury, "Qualitative Fault Isolation of Hybrid Systems: A Structural Model Decomposition-Based Approach," *Third European Conference of the PHM Society 2016*, pp. 515-525, Bilbao, Spain, July 2016.
- [C4] I. Roychoudhury, **M. Daigle**, K. Goebel, L. Spirkovska, S. Sankararaman, J. Ossenfort, C. Kulka-rni, W. McDermott, and S. Poll, "Initial Demonstration of the Real-time Safety Monitoring Framework for the National Airspace System Using Flight Data," *16th AIAA Aviation Technology, Integration, and Operations Conferenc*, Washington, D.C., June 2016.

- [C5] Q. Gaudel, P. Ribot, E. Chantry, and **M. Daigle**, "Health Monitoring of a Planetary Rover Using Hybrid Particle Petri Nets," *37th International Conference on Applications and Theory of Petri Nets and Concurrency*, pp. 196-215, Torun, Poland, June 2016.
- [C6] **M. Daigle** and C. Kulkarni, "End-of-discharge and End-of-life Prediction in Lithium-ion Batteries with Electrochemistry-based Aging Models," *AIAA Infotech@Aerospace Conference*, San Diego, CA, January 2016.
- [C7] I Roychoudhury, L Spirkovska, M Daigle, E Balaban, S Sankararaman, C. Kulkarni, S. Poll, and K. Goebel, "Predicting Real-Time Safety of the National Airspace System," *AIAA Infotech@Aerospace Conference*, San Diego, CA, January 2016.
- [C8] **M. Daigle**, "Real-time Prognostics of a Rotary Valve Actuator," *Annual Conference of the Prognostics and Health Management Society 2015*, pp. 46-56, San Diego, CA, October 2015.
- [C9] **M. Daigle**, I. Roychoudhury, and A. Bregon, "Model-based Prognostics of Hybrid Systems," *Annual Conference of the Prognostics and Health Management Society 2015*, pp. 57-66, San Diego, CA, October 2015.
- [C10] **M. Daigle**, A. Bregon, and I. Roychoudhury, "A Structural Model Decomposition Framework for Hybrid Systems Diagnosis," *26th International Workshop on Principles of Diagnosis*, pp. 201-208, Paris, France, August 2015.
- [C11] A. Bregon, **M. Daigle**, and I. Roychoudhury, "An Integrated Framework for Distributed Diagnosis of Process and Sensor Faults," *2015 IEEE Aerospace Conference*, Big Sky, MT, March 2015.
- [C12] **M. Daigle**, S. Sankararaman, and C. Kulkarni, "Stochastic Prediction of Remaining Driving Time and Distance for a Planetary Rover," *2015 IEEE Aerospace Conference*, Big Sky, MT, March 2015.
- [C13] C. Kulkarni, **M. Daigle**, G. Gorospe, and K. Goebel, "Application of Model Based Prognostics to Pneumatic Valves in a Cryogenic Propellant Loading Testbed," *AIAA SciTech Conference*, Kissimmee, FL, January 2015.
- [C14] C. Kulkarni, **M. Daigle**, G. Gorospe, and K. Goebel, "Validation of Model-Based Prognostics for Pneumatic Valves in a Demonstration Testbed," *Annual Conference of the Prognostics and Health Management Society 2014*, pp. 76-85, Fort Worth, TX, September 2014. (nominated for best paper award)
- [C15] B. Bole, C. Kulkarni, and **M. Daigle**, "Adaptation of an Electrochemistry-based Li-Ion Battery Model to Account for Deterioration Observed Under Randomized Use," *Annual Conference of the Prognostics and Health Management Society 2014*, pp. 502-510, Fort Worth, TX, September 2014.
- [C16] A. Sweet, G. Gorospe, **M. Daigle**, J. Celaya, E. Balaban, I. Roychoudhury, and S. Narasimhan, "Demonstration of Prognostics-Enabled Decision Making Algorithms on a Hardware Mobile Robot Test Platform," *Annual Conference of the Prognostics and Health Management Society 2014*, pp. 142-150, Fort Worth, TX, September 2014.
- [C17] **M. Daigle**, I. Roychoudhury, and A. Bregon, "Qualitative Event-Based Fault Isolation under Uncertain Observations," *Annual Conference of the Prognostics and Health Management Society 2014*, pp. 347-355, Fort Worth, TX, September 2014.
- [C18] **M. Daigle**, I. Roychoudhury, and A. Bregon, "Integrated Diagnostics and Prognostics for the Electrical Power System of a Planetary Rover," *Annual Conference of the Prognostics and Health Management Society 2014*, pp. 128-141, Fort Worth, TX, September 2014.
- [C19] C. Kulkarni, G. Gorospe, **M. Daigle**, and K. Goebel, "A Testbed for Implementing Prognostic Methodologies on Cryogenic Propellant Loading Systems," *2014 IEEE Systems Readiness Technology Conference (AUTOTESTCON)*, pp. 280-289, St. Louis, MO, September 2014. (best paper award)
- [C20] **M. Daigle**, I. Roychoudhury, and A. Bregon, "Diagnosability-Based Sensor Placement through Structural Model Decomposition," *Second European Conference of the Prognostics and Health Management Society 2014*, pp. 33-46, Nantes, France, July 2014.

- [C21] B. Bole, **M. Daigle**, and G. Gorospe, "Online Prediction of Battery Discharge and Estimation of Parasitic Loads for an Electric Aircraft," *Second European Conference of the Prognostics and Health Management Society 2014*, pp. 23-32, Nantes, France, July 2014.
- [C22] **M. Daigle**, C. Kulkarni, and G. Gorospe, "Application of Model-based Prognostics to a Pneumatic Valves Testbed," *2014 IEEE Aerospace Conference*, Big Sky, MT, March 2014.
- [C23] **M. Daigle** and C. Kulkarni, "A Battery Health Monitoring Framework for Planetary Rovers," *2014 IEEE Aerospace Conference*, Big Sky, MT, March 2014. (best paper award)
- [C24] C. Teubert and **M. Daigle**, "Current/Pressure Transducer Application of Model-Based Prognostics using Steady State Conditions," *2014 IEEE Aerospace Conference*, Big Sky, MT, March 2014.
- [C25] **M. Daigle**, I. Roychoudhury, and A. Bregon, "Qualitative Event-based Diagnosis with Possible Conflicts: Case Study on the Fourth International Diagnostic Competition," *Proceedings of the 24th International Workshop on Principles of Diagnosis*, pp. 230-235, Jerusalem, Israel, October 2013.
- [C26] A. Sweet, A. Feldman, S. Narasimhan, **M. Daigle**, and S. Poll, "Fourth International Diagnostic Competition - DXC'13," *Proceedings of the 24th International Workshop on Principles of Diagnosis*, pp. 224-229, Jerusalem, Israel, October 2013.
- [C27] C. Quach, B. Bole, E. Hogge, S. Vazquez, **M. Daigle**, J. Celaya, A. Weber, and K. Goebel, "Battery Charge Depletion Prediction on an Electric Aircraft," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 503-512, New Orleans, LA, October 2013.
- [C28] J. Barber, K. Johnston, and **M. Daigle**, "A Cryogenic Fluid System Simulation in Support of Integrated Systems Health Management," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 114-126, New Orleans, LA, October 2013.
- [C29] C. Teubert and **M. Daigle**, "I/P Transducer Application of Model-Based Wear Detection and Estimation using Steady State Conditions," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 134-140, New Orleans, LA, October 2013.
- [C30] **M. Daigle** and C. Kulkarni, "Electrochemistry-based Battery Modeling for Prognostics," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 249-261, New Orleans, LA, October 2013. (nominated for best paper award)
- [C31] **M. Daigle** and S. Sankararaman, "Advanced Methods for Determining Prediction Uncertainty in Model-Based Prognostics with Application to Planetary Rovers," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 262-274, New Orleans, LA, October 2013. (nominated for best paper award)
- [C32] A. Bregon, S. Narasimhan, I. Roychoudhury, **M. Daigle**, and B. Pulido, "An Efficient Model-based Diagnosis Engine for Hybrid Systems using Structural Model Decomposition," *Annual Conference of the Prognostics and Health Management Society 2013*, pp. 312-324, New Orleans, LA, October 2013.
- [C33] C. Kulkarni, **M. Daigle**, and K. Goebel, "Implementation of Prognostic Methodologies to Cryogenic Propellant Loading Testbed," *2013 IEEE Systems Readiness Technology Conference (AUTOTEST-CON)*, pp. 314-320, Schaumburg, IL, September 2013.
- [C34] I. Roychoudhury, **M. Daigle**, A. Bregon, and B. Pulido, "A Structural Model Decomposition Framework for Systems Health Management," *2013 IEEE Aerospace Conference*, Big Sky, MT, March 2013.
- [C35] S. Sankararaman, **M. Daigle**, A. Saxena, and K. Goebel, "Analytical Algorithms to Quantify the Uncertainty in Remaining Useful Life Prediction," *2013 IEEE Aerospace Conference*, Big Sky, MT, March 2013.
- [C36] **M. Daigle**, A. Bregon, and I. Roychoudhury, "A Distributed Approach to System-Level Prognostics," *Annual Conference of the Prognostics and Health Management Society 2012*, pp. 71-82, Minneapolis, MN, September 2012.

- [C37] **M. Daigle**, A. Saxena, and K. Goebel, "An Efficient Deterministic Approach to Model-based Prediction Uncertainty Estimation," *Annual Conference of the Prognostics and Health Management Society 2012*, pp. 326-335, Minneapolis, MN, September 2012.
- [C38] A. Bregon, **M. Daigle**, and I. Roychoudhury, "An Integrated Framework for Model-based Distributed Diagnosis and Prognosis," *Annual Conference of the Prognostics and Health Management Society 2012*, pp. 416-426, Minneapolis, MN, September 2012.
- [C39] S. Narasimhan, E. Balaban, **M. Daigle**, I. Roychoudhury, A. Sweet, J. Celaya, and K. Goebel, "Autonomous Decision Making for Planetary Rovers Using Diagnostic and Prognostic Information," *8th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes*, pp. 289-294, Mexico City, Mexico, August 2012.
- [C40] **M. Daigle**, A. Bregon, G. Biswas, X. Koutsoukos, and B. Pulido, "Improving Multiple Fault Diagnosability using Possible Conflicts," *8th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes*, pp. 144-149, Mexico City, Mexico, August 2012.
- [C41] **M. Daigle**, A. Bregon, and I. Roychoudhury, "Qualitative Event-based Diagnosis with Possible Conflicts Applied to Spacecraft Power Distribution Systems," *8th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes*, pp. 265-270, Mexico City, Mexico, August 2012.
- [C42] A. Bregon, **M. Daigle**, and I. Roychoudhury, "An Integrated Model-Based Distributed Diagnosis and Prognosis Framework," *Proceedings of the 23rd International Workshop on Principles of Diagnosis*, pp. 3-10, Great Malvern, U.K., July 2012.
- [C43] **M. Daigle**, B. Saha, and K. Goebel, "A Comparison of Filter-based Approaches for Model-based Prognostics," *2012 IEEE Aerospace Conference*, Big Sky, MT, March 2012.
- [C44] S. Poll, J. de Kleer, R. Abreau, **M. Daigle**, A. Feldman, D. Garcia, A. Gonzalez-Sanchez, T. Kurtoglu, S. Narasimhan, and A. Sweet, "Third International Diagnostic Competition - DXC'11," *Proceedings of the 22nd International Workshop on Principles of Diagnosis*, pp. 267-278, Murnau, Germany, October 2011.
- [C45] **M. Daigle**, A. Bregon, and I. Roychoudhury, "Qualitative Event-based Diagnosis with Possible Conflicts: Case Study on the Third International Diagnostic Competition," *Proceedings of the 22nd International Workshop on Principles of Diagnosis*, pp. 285-292, Murnau, Germany, October 2011.
- [C46] A. Bregon, **M. Daigle**, I. Roychoudhury, G. Biswas, X. Koutsoukos, and B. Pulido, "Improving Distributed Diagnosis Through Structural Model Decomposition," *Proceedings of the 22nd International Workshop on Principles of Diagnosis*, pp. 195-202, Murnau, Germany, October 2011.
- [C47] I. Roychoudhury and **M. Daigle**, "An Integrated Model-Based Diagnostic and Prognostic Framework," *Proceedings of the 22nd International Workshop on Principles of Diagnosis*, pp. 44-51, Murnau, Germany, October 2011.
- [C48] **M. Daigle**, A. Bregon, and I. Roychoudhury, "Distributed Damage Estimation for Prognostics Based on Structural Model Decomposition," *Proceedings of the Annual Conference of the Prognostics and Health Management Society 2011*, pp. 198-208, Montreal, Quebec, Canada, September 2011. (nominated for best paper award)
- [C49] **M. Daigle**, I. Roychoudhury, S. Narasimhan, S. Saha, B. Saha, and K. Goebel, "Investigating the Effect of Damage Progression Model Choice on Prognostics Performance," *Proceedings of the Annual Conference of the Prognostics and Health Management Society 2011*, pp. 323-333, Montreal, Quebec, Canada, September 2011. (won best paper award - theory paper)
- [C50] E. Balaban, S. Narasimhan, **M. Daigle**, J. Celaya, I. Roychoudhury, B. Saha, S. Saha, and K. Goebel, "A Mobile Robot Testbed for Prognostics-Enabled Autonomous Decision Making," *Proceedings of the Annual Conference of the Prognostics and Health Management Society 2011*, pp. 15-30, Montreal, Quebec, Canada, September 2011. (nominated for best paper award)
- [C51] **M. Daigle** and K. Goebel, "Multiple Damage Progression Paths in Model-based Prognostics," *Proceedings of the 2011 IEEE Aerospace Conference*, Big Sky, MT, March 2011.

- [C52] **M. Daigle**, M. Foygel, and V. Smelyanskiy, "Model-based Diagnostics for Propellant Loading Systems," *Proceedings of the 2011 IEEE Aerospace Conference*, Big Sky, MT, March 2011.
- [C53] **M. Daigle** and I. Roychoudhury, "Qualitative Event-based Diagnosis: Case Study on the Second International Diagnostic Competition," *Proceedings of the 21st International Workshop on Principles of Diagnosis*, pp. 371-378, Portland, OR, October 2010.
- [C54] **M. Daigle**, I. Roychoudhury, G. Biswas, and X. Koutsoukos, "An Event-based Approach to Distributed Diagnosis of Continuous Systems," *Proceedings of the 21st International Workshop on Principles of Diagnosis*, pp. 15-22, Portland, OR, October 2010.
- [C55] **M. Daigle** and K. Goebel, "Improving Computational Efficiency of Prediction in Model-based Prognostics Using the Unscented Transform," *Proceedings of the Annual Conference of the Prognostics and Health Management Society 2010*, Portland, OR, October 2010.
- [C56] **M. Daigle** and K. Goebel, "Model-based Prognostics under Limited Sensing," *2010 IEEE Aerospace Conference*, Big Sky, MT, March 2010.
- [C57] **M. Daigle** and K. Goebel, "Model-based Prognostics with Fixed-lag Particle Filters," *Proceedings of the Annual Conference of the Prognostics and Health Management Society 2009*, San Diego, CA, September 2009.
- [C58] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Improving Diagnosability of Hybrid Systems through Active Diagnosis," *Proceedings of the 7th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes*, pp. 217-222, Barcelona, Spain, July 2009. (invited paper)
- [C59] I. Roychoudhury, **M. Daigle**, G. Biswas, X. Koutsoukos, A. Patterson-Hine, and S. Poll, "Comprehensive Diagnosis of Complex Electrical Power Distribution Systems," *Proceedings of the 7th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes*, pp. 722-727, Barcelona, Spain, July 2009. (invited paper, session acceptance rate 33%)
- [C60] C. Goodrich, S. Narasimhan, **M. Daigle**, W. Hatfield, R. Johnson, and B. Brown, "Applying Model-based Diagnosis to a Rapid Propellant Loading System," *Proceedings of the 20th International Workshop on Principles of Diagnosis*, pp. 147-154, Stockholm, Sweden, June 2009.
- [C61] **M. Daigle**, X. Koutsoukos, and G. Biswas, "An Event-based Approach to Hybrid Systems Diagnosability," *Proceedings of the 19th International Workshop on Principles of Diagnosis*, pp. 47-54, September 2008.
- [C62] I. Roychoudhury, **M. Daigle**, G. Biswas, and X. Koutsoukos, "Efficient Simulation of Hybrid Systems: An Application to Electrical Power Distribution Systems," *Proceedings of the 22nd European Conference on Modeling and Simulation*, pp. 471-477, Nicosia, Cyprus, June 2008.
- [C63] **M. Daigle**, X. Koutsoukos, and G. Biswas, "An Integrated Approach to Parametric and Discrete Fault Diagnosis in Hybrid Systems," *Hybrid Systems: Computation and Control (HSCC 2008)*, *Lecture Notes in Computer Science*, vol. 4981, pp. 614-617, St. Louis, MO, April 2008. (short paper)
- [C64] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Fault Diagnosis of Continuous Systems Using Discrete-Event Methods," *Proceedings of the 46th IEEE Conference on Decision and Control*, pp. 2626-2632, New Orleans, LA, Dec 2007.
- [C65] **M. Daigle**, X. Koutsoukos, and G. Biswas, "A Qualitative Approach to Multiple Fault Isolation in Continuous Systems," *Proceedings of the Twenty-Second AAAI National Conference 2007*, pp. 293-298, Vancouver, British Columbia, Canada, July 2007. (acceptance rate 27%)
- [C66] **M. Daigle**, X. Koutsoukos, and G. Biswas, "On Discrete Event Diagnosis Methods for Continuous Systems," *Proceedings of the 15th IEEE Mediterranean Conference on Control and Automation*, June 2007.
- [C67] **M. Daigle**, X. Koutsoukos, and G. Biswas, "A Discrete Event Approach to Diagnosis of Continuous Systems," *Proceedings of the 18th International Workshop on Principles of Diagnosis*, pp. 259-266, Nashville, TN, May 2007.
- [C68] S. Poll, A. Patterson-Hine, J. Camisa, D. Garcia, D. Hall, C. Lee, O. Mengshoel, C. Neukom, D. Nishikawa, J. Ossenfort, A. Sweet, S. Yentus, I. Roychoudhury, **M. Daigle**, G. Biswas, and X. Koutsoukos, "Advanced Diagnostics and Prognostics Testbed," *Proceedings of the 18th International Workshop on Principles of Diagnosis*, pp. 178-185, Nashville, TN, May 2007.

- [C69] A. Moustafa, **M. Daigle**, I. Roychoudhury, C. Shantz, G. Biswas, S. Mahadevan, and X. Koutsoukos, "Fault Diagnosis of Civil Engineering Structures using the Bond Graph Approach," *Proceedings of the 18th International Workshop on Principles of Diagnosis*, pp. 146-153, Nashville, TN, May 2007.
- [C70] **M. Daigle**, I. Roychoudhury, G. Biswas, and X. Koutsoukos, "Efficient Simulation of Component-Based Hybrid Models Represented as Hybrid Bond Graphs," *Hybrid Systems: Computation and Control (HSCC 2007), Lecture Notes in Computer Science*, vol. 4416, pp. 680-683, Pisa, Italy, April 2007. (short paper)
- [C71] I. Roychoudhury, **M. Daigle**, X. Koutsoukos, G. Biswas, and P. J. Mosterman, "A Method for Efficient Simulation of Hybrid Bond Graphs," *Proceedings of the International Conference on Bond Graph Modeling and Simulation (ICBGM 2007)*, pp. 177-184, San Diego, CA, January 2007.
- [C72] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Multiple Fault Diagnosis in Complex Physical Systems," *Proceedings of the 17th International Workshop on Principles of Diagnosis*, pp. 69-76, June 2006.
- [C73] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Distributed Diagnosis of Coupled Mobile Robots," *Proceedings of the 2006 IEEE International Conference on Robotics and Automation*, pp. 3787-3794, Orlando, FL, May 2006. (acceptance rate 39%)
- [C74] S. Bringsjord, S. Khemlani, K. Arkoudas, C. McEvoy, M. Destefano, and **M. Daigle**, "Advanced Synthetic Characters, Evil, and E," *Game-On 2005, 6th International Conference on Intelligent Games and Simulation*, pp. 31-39, Leicester, United Kingdom, November 2005. (won best paper award)

Unrefereed Conference Proceedings

- [U1] **M. Daigle** and K. Goebel, "Prognostics for Ground Support Systems: Case Study on Pneumatic Valves," *Proceedings of AIAA Infotech@Aerospace 2011 Conference*, St. Louis, MO, March 2011.
- [U2] M. S. Feather, K. Goebel, and **M. Daigle**, "Tackling Verification and Validation for Prognostics," *Proceedings of the SpaceOps 2010 Conference*, Huntsville, AL, April 2010.
- [U3] S. Poll, A. Patterson-Hine, J. Camisa, D. Nishikawa, L. Spirkovska, D. Garcia, D. Hall, C. Neukom, A. Sweet, S. Yentus, C. Lee, J. Ossenfort, I. Roychoudhury, **M. Daigle**, G. Biswas, X. Koutsoukos, and R. Lutz, "Evaluation, Selection, and Application of Model-Based Diagnosis Tools and Approaches," *AIAA Infotech@Aerospace 2007 Conference and Exhibit*, May 2007.
- [U4] **M. Daigle**, X. Koutsoukos, and G. Biswas, "Relative Measurement Orderings in Diagnosis of Distributed Physical Systems," *Proceedings of the 43rd Annual Allerton Conference on Communication, Control, and Computing*, pp. 1707-1716, Allerton, IL, September 2005. (invited paper)

Technical Reports

- [T1] I. Roychoudhury, L. Spirkovska, **M. Daigle**, E. Balaban, S. Sankararaman, C. Kulkarni, S. Poll, and K. Goebel, "Real-Time Monitoring and Prediction of Airspace Safety," *NASA/TM-2015-218928*, NASA Ames Research Center, December 2015.
- [T2] V. Osipov, C. Muratov, **M. Daigle**, M. Foygel, V. Smelyanskiy, and A. Patterson-Hine, "A Dynamical Physics Model of Nominal and Faulty Operational Modes of Propellant Loading (Liquid Hydrogen): From Space Shuttle to Future Missions," *NASA/TM-2010-216394*, NASA Ames Research Center, July 2010.
- [T3] **M. Daigle**, I. Roychoudhury, G. Biswas, X. Koutsoukos, A. Patterson-Hine, and S. Poll, "A Comprehensive Diagnosis Methodology for Complex Hybrid Systems: A Case Study on Spacecraft Power Distribution Systems," *Technical Report ISIS-08-908*, Institute for Software Integrated Systems, Vanderbilt University, December 2008.
- [T4] **M. Daigle**, X. Koutsoukos, and G. Biswas, "An Integrated Approach to Parametric and Discrete Fault Diagnosis in Hybrid Systems," *Technical Report ISIS-07-815*, Institute for Software Integrated Systems, Vanderbilt University, January 2008.

- [T5] **M. Daigle**, I. Roychoudhury, G. Biswas, and X. Koutsoukos, "Efficient Simulation of Component-Based Hybrid Models Represented as Hybrid Bond Graphs," *Technical Report ISIS-06-712*, Institute for Software Integrated Systems, Vanderbilt University, December 2006.

AWARDS AND HONORS

- 2016 NASA Group Achievement Award, Airspace Real-Time Safety Modeling Team, NASA Ames Research Center
- 2016 NASA Group Achievement Award, Advanced Ground Systems Maintenance Team, NASA Ames Research Center
- 2015 NASA Group Achievement Award, Prognostics Flight Demonstration Team, NASA Ames Research Center
- 2014 NASA Early Career Achievement Medal, NASA Ames Research Center
- 2014 NASA Group Achievement Award, Prognostics Team, NASA Ames Research Center
- 2014 Tech Brief Award, CryoSim KSC-13847, NASA Ames Research Center
- 2014 IEEE Autotestcon, Best Paper Award
- 2014 IEEE Aerospace Conference, Best Paper Award
- 2013 Fourth International Diagnostic Competition, Diagnostic Problem I, First Place
- 2011 NASA Group Achievement Award, CEV 80-AS Wind Tunnel Test Team, NASA Ames Research Center
- 2011 Ames Contractor Council Excellence Award, NASA Ames Research Center
- 2011 Annual Conference of the Prognostics and Health Management Society, Best Theory Paper Award
- 2011 Third International Diagnostic Competition, Diagnostic Problem I, First Place
- 2011 Staff Recognition and Development Award, University of California, Santa Cruz
- 2009 Staff Recognition and Development Award, University of California, Santa Cruz
- 2004 Research Assistantship, Vanderbilt University (2004–2008)
- 2004 University Graduate Fellowship, Vanderbilt University (2004–2008)

INVITED TALKS

- 2014 "Model-based Prognostics", Palo Alto Research Center (PARC), Palo Alto, California, USA, November, 2014
- 2014 "Model-based Prognostics", Decision & Optimization Department Seminar, LAAS-CNRS, Toulouse, France, July, 2014
- 2014 "Model-based Prognostics" (Tutorial), Annual Conference of the Prognostics and Health Management Society 2014, Fort Worth, TX, October, 2014

RESEARCH EXPERIENCE

- 2014–Present Real-time Safety Monitoring and Prediction for the National Airspace: Developed framework and algorithms for real-time safety monitoring and prediction of the national airspace. Demonstrated in simulation.

- 2013–Present Prognostics and Decision-Making for Electric Aircraft: Researched and developed new battery models and algorithms for battery health monitoring with application to electric aircraft. Integration with mission planning and decision-making algorithms.
- 2010–Present Physics-based Simulation of Cryogenic Propellant Loading Systems: Lead in development of physics-based simulation for cryogenic propellant loading system testbed. Developed physics models of components and testbed in Matlab/Simulink with fault injection capability for one- and two-phase flow. Supervised development of simulation architecture and user interfaces.
- 2008–Present Model-based Prognostics with Application to Cryogenic Propellant Loading Systems: Researched model-based prognostics methods for pneumatic valves, current-pressure transducers, solenoid valves, centrifugal pumps, and lithium-ion batteries. Constructed pneumatic valve testbed for algorithm validation.
- 2013–2014 Battery Health Management for Spacecraft: Researched and developed new battery models and algorithms for battery health monitoring with application to spacecraft. Deployed for EFT-1 mission.
- 2011–2014 Prognostics and Decision-Making for Planetary Rovers: Researched and developed algorithms for battery health monitoring, integrated diagnosis and prognosis, future usage modeling, and uncertainty quantification. Developed physics-based rover simulation and framework for simulation-based algorithm validation.
- 2008–2009 Model-based Diagnosis with Application to Rapid Propellant Loading: Developed MATLAB/Simulink simulation of Rapid Propellant Loading testbed, including nominal and faulty operation. Developed simulation interface for fault injection, data recording, and integration with the Hybrid Diagnostic Engine (HyDE).
- 2000–2004 Hybrid Systems Diagnosis with Application to Electrical Power Systems: Developed formal event-based framework for single and multiple fault diagnosis based on temporal orders of measurement deviations. Researched discrete fault diagnosis in hybrid systems based on qualitative algorithms. Implemented algorithms in the Fault Adaptive Control Technology (FACT) software. Applied to Advanced Diagnostics and Prognostics Testbed.
- 2000-2004 Distributed Diagnosis with Application to Mobile Robots Researched distributed diagnosis of multi-robot systems. Implemented distributed fault detection and isolation algorithms and performed experimental studies for box-pushing and formation-keeping tasks.

SOFTWARE IMPLEMENTATIONS

- 2016 **Prognostics Model Library:** The Prognostics Model Library is a modeling framework focused on defining and building models for prognostics (computation of remaining useful life) of engineering systems, and provides a set of prognostics models for select components developed within this framework, suitable for use in prognostics applications for these components. The library currently includes models for valves, pumps, and batteries. The Prognostics Model Library is implemented in MATLAB. The implementation consists of a set of utilities for defining a model (specifying variables, parameters, and equations), simulating the model, and embedding it within common model-based prognostics algorithms. A user can use existing models within the library or construct new models with the provided framework.
<https://github.com/nasa/PrognosticsModelLibrary>
- 2016 **Prognostics Algorithm Library:** The Prognostics Algorithm Library is a suite of algorithms implemented in the MATLAB programming language for model-based prognostics (remaining life computation). It includes algorithms for state estimation and prediction, including uncertainty propagation. The algorithms take as inputs component models developed in Matlab, and perform estimation and prediction functions. The library allows the

rapid development of prognostics solutions for given models of components and systems. Different algorithms can be easily swapped to do comparative studies and evaluations of different algorithms to select the best for the application at hand.
<https://github.com/nasa/PrognosticsAlgorithmLibrary>

- 2013–Present **CryoSim**: A MATLAB/Simulink physics simulation of a cryogenic propellant loading system testbed. Includes fault injection capability, a graphical user interface, and support for model variants. Can be used for systems health management algorithm validation and operator training.
- 2008–Present **Qualitative Event-based Diagnosis (QED)**: A C++ and MATLAB tool suite for qualitative event-based diagnosis of continuous systems using structural model decomposition. Entered into the Second, Third, and Fourth International Diagnostic Competitions.
- 2007–2008 **Modeling and Transformation of Hybrid Bond Graphs for Simulation (MOTHS) Tool Suite**: Set of tools for translating hybrid bond graph models created in the Fault Adaptive Control Technology (FACT) modeling paradigm into MATLAB/Simulink models. Part of the FACT release.
- 2006–2007 **VIRTUAL ADAPT**: Portable simulation environment for Advanced Diagnostics and Prognostics Testbed (ADAPT) at NASA Ames Research Center based on MOTHS technology. Currently used by researchers with ADAPT-related projects. Part of the Antagonist functionality in ADAPT. Used for experimental user interaction studies for the Advanced Caution and Warning project at NASA Ames.
- 2004–2008 **Fault Adaptive Control Technology**: Implemented extensions to the qualitative fault isolation algorithms for diagnosis with measurement orderings and diagnosis of discrete faults.
<http://fact.isis.vanderbilt.edu/>

PROFESSIONAL SERVICE

Reviewing

- 2016 IEEE Aerospace Conference
- 2016 International Workshop on Principles of Diagnosis
- 2016 Annual Conference of the Prognostics and Health Management Society
- 2016 European Conference of the Prognostics and Health Management Society
- 2016 IEEE Transactions on Systems, Man, and Cybernetics: Systems
- 2016 IEEE Conference on Control and Fault-Tolerant Systems
- 2016 25th International Joint Workshop on Artificial Intelligence
- 2016 International Journal of Prognostics and Health Management
- 2015 IEEE Transactions on Systems, Man, and Cybernetics: Systems
- 2015 IEEE Transactions on Reliability
- 2015 International Journal of Prognostics and Health Management
- 2015 IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes
- 2015 Annual Conference of the Prognostics and Health Management Society
- 2015 International Workshop on Principles of Diagnosis
- 2015 IEEE Aerospace Conference
- 2014 European Conference of the Prognostics and Health Management Society
- 2014 Annual Conference of the Prognostics and Health Management Society
- 2014 NASA Technology Roadmap

- 2014 International Journal of Prognostics and Health Management
- 2014 IEEE Transactions on Reliability
- 2014 IEEE Aerospace Conference
- 2014 International Workshop on Principles of Diagnosis
- 2013 Annual Conference of the Prognostics and Health Management Society
- 2013 IEEE Aerospace Conference
- 2013 Engineering Applications of Artificial Intelligence
- 2013 International Workshop on Principles of Diagnosis
- 2012 IEEE Transactions on Automation Science and Engineering
- 2012 IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes
- 2012 European Conference of the Prognostics and Health Management Society
- 2012 IEEE Transactions on Reliability
- 2012 Annual Conference of the Prognostics and Health Management Society
- 2012 International Journal of Systems Science
- 2012 IEEE Transactions on Automatic Control
- 2012 IEEE Transactions on Systems, Man, and Cybernetics, Part A: Systems and Humans
- 2012 International Workshop on Principles of Diagnosis
- 2012 Discrete Event Dynamic Systems
- 2011 Annual Conference of the Prognostics and Health Management Society
- 2011 International Workshop on Principles of Diagnosis
- 2011 ASME International Design Engineering Technical Conference
- 2011 IFAC World Congress
- 2010 International Workshop on Principles of Diagnosis
- 2010 IEEE Conference on Robotics and Automation
- 2010 IEEE International Symposium on Industrial Electronics
- 2010 IEEE Aerospace Conference
- 2009 International Workshop on Principles of Diagnosis
- 2009 IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes
- 2009 Annual Conference of the Prognostics and Health Management Society
- 2009 IEEE Real-Time and Embedded Technology and Applications Symposium
- 2008 Simulation Modelling Practice and Theory
- 2008 International Conference on Prognostics and Health Management
- 2007 International Workshop on Principles of Diagnosis
- 2006 International Workshop on Principles of Diagnosis

Conference Organization

- 2016 IEEE Aerospace Conference, Session Organizer
- 2016 European Conference of the Prognostics and Health Management Society, Technical Program Committee
- 2016 Annual Conference of the Prognostics and Health Management Society, Proceedings Chair
- 2016 International Workshop on Principles of Diagnosis, Program Committee
- 2016 25th International Joint Workshop on Artificial Intelligence, Program Committee

- 2015 IEEE Aerospace Conference, Session Organizer
- 2015 Annual Conference of the Prognostics and Health Management Society, Technical Program Committee, Proceedings Chair
- 2015 International Workshop on Principles of Diagnosis, Program Committee
- 2014 IEEE Aerospace Conference, Session Organizer
- 2014 International Workshop on Principles of Diagnosis, Program Committee
- 2014 European Conference of the Prognostics and Health Management Society, Proceedings Chair
- 2014 Annual Conference of the Prognostics and Health Management Society, Technical Program Committee, Proceedings Chair
- 2013 IEEE Aerospace Conference, Session Organizer
- 2013 Annual Conference of the Prognostics and Health Management Society, Technical Program Committee
- 2013 International Workshop on Principles of Diagnosis, Program Committee
- 2013 International Diagnostic Competition, Organizing Committee
- 2012 IEEE Aerospace Conference, Session Organizer
- 2012 International Workshop on Principles of Diagnosis, Program Committee
- 2011 International Diagnostic Competition, Organizing Committee
- 2010 International Workshop on Principles of Diagnosis, Workshop Organizing Committee
- 2007 International Workshop on Principles of Diagnosis, Workshop Organizing Committee, Webmaster

PROFESSIONAL MEMBERSHIPS

- 2009–Present PHM Society, Member
- 2007–Present IEEE, Graduate Student Member 2007, Member 2008, Senior Member 2015