

John D. Hedengren

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SUMMARY

I am an Associate Professor at Brigham Young University in the Chemical Engineering Department and lead the PRISM (Process Research and Intelligent System Modeling) group (<http://apm.byu.edu/prism>). I am a chemical engineer by training with a B.S. and M.S. degree from Brigham Young University, and a Ph.D. from the University of Texas at Austin. I consulted for many large petrochemical companies on automation solutions and then full-time for 5 years with ExxonMobil supporting advanced control and optimization solutions. I have experience with industrial control PLC and DCS systems including Honeywell TPS/TDC3000, Experion system, OPC, and Modbus. My area of expertise is in process dynamics, control, and optimization with applications in fiber optic monitoring, automation of oil and gas processes, unmanned aerial systems, systems biology, and grid-scale energy systems. In chemicals manufacturing, I have extensive experience in automation and modeling of the production of polymers such as polyethylene, polypropylene, butyl rubber, and polystyrene as well as specialty chemicals. Automation software (APMonitor / GEKKO) that I developed has been applied in over 100 industrial applications world-wide in refineries, chemical plants, and off-shore oil platforms. I teach courses on computational methods, process dynamics and control, optimization, dynamic optimization, and fundamentals of chemical engineering. I have co-authored 54 journal publications that span topics of oil production, drilling automation, smart grid optimization, unmanned aerial systems, and nonlinear predictive control. My publications have been cited over 1000 times with a combined h-index of 20 and an i10-index of 36. My professional service includes appointments as a 2018-19 Distinguished Lecturer for the Society of Petroleum Engineers, BYU SPE Club Advisor, Adjunct Professor at the University of Utah, Associate Editor for the Processes Journal, and member of the AIChE CAST (Computing and Systems Technology) executive committee.



RELATED EXPERIENCE

Brigham Young University , Provo, Utah Associate Professor in Chemical Engineering	Aug 2016-Present
University of Utah , Salt Lake City, Utah Adjunct Professor in Chemical Engineering	Jan 2018-Present
Brigham Young University , Provo, Utah Assistant Professor in Chemical Engineering	Aug 2011-2016
ExxonMobil Chemical , Baytown, Texas Supporting world-wide operations as a member of Central Engineering (2010)	April 2007-Aug 2011

Developed optimization software (APMonitor) used through-out the corporation
Coordinated funding, hiring, and work assignments for student Ph.D. interns

APMonitor, Business Startup Jan 2007-April 2007, 2011-Present
Started a consulting company for advanced process modeling and control
Software deployed worldwide in petrochemical and upstream oil and gas operations

PAS, Inc., Advanced Process Control Development May 2005-Jan. 2007
Developed first principles models for homopolymer and impact polypropylene reactors
Conducted APC training seminars for internal and external clients
Commissioned 3 Unipol reactor APC applications as lead technical engineer

Advanced Process Control Research (UT Austin PhD) Sept. 2002-May 2005
Created an object oriented first principles modeling simulation environment
Developed methods to significantly reduce nonlinear MPC computational time
Explored large-scale model reduction
Developed real-time advanced control strategies of large-scale first principles models

ExxonMobil Chemical, Baytown, Texas April 2004-June 2004
Developed advanced process control for polymer production
Worked with plant operators and technical specialists to develop a model
Trained other engineers to use advanced control technology

Rocket Propellant Combustion Modeling (BYU MS) May 2001-Aug. 2002
Explored 'time to detonation' of a rocket motor in a pool fire
Improved speed of gaseous HMX reaction calculations by 10 times

CH2MHill Internship, Hanford, Washington June 2000-Aug. 2000
Determined pipe flushing requirements for radioactive waste
Worked on a team to maintain liquid pumping from radioactive waste tanks

BNFL Inc. Internship, Hanford, Washington June 1999-Aug. 1999
Performed design work for vitrification (molten glass encapsulation)
Analyzed corrosion for all major plant vessels handling radioactive sludge
Prepared reports for the US Department of Ecology and other clients

BYU DIPPR Thermophysical Properties Lab April 1999-June 1999
Predicted surface tensions for over 700 compounds
Verified predicted values with experimental data

EDUCATION

Ph.D., Chemical Engineering Aug 2002-May 2005
University of Texas at Austin, Summa Cum Laude
Advisor: Thomas F. Edgar
Dissertation: Real-Time Estimation and Control of Large-Scale Nonlinear DAE Systems

M.S., Chemical Engineering May 2001-Aug. 2002
Brigham Young University, Magna Cum Laude
Advisor: Merrill W. Beckstead
Thesis: Implementation of Automatically Simplified Chemical Kinetics through Intrinsic Low-Dimensional Manifolds for Gaseous HMX

B.S. Chemical Engineering
Brigham Young University, Magna Cum Laude

Aug 1995-May 2001

Undergraduate Research: DIPPR (Oscarson, Rowley, Wilding), Catalysis Lab (Huber, Bartholomew, Hecker),
Combustion Lab (Fletcher)

TEACHING

CH EN 263	Computational Tools
CH EN 273	Fundamentals of Chemical Engineering
CH EN 436	Process Dynamics and Control
CH EN 475	Unit Operations Lab I
CH EN 477	Unit Operations Lab II
CH EN 691R/791R	Graduate Seminar
CH EN 593R/693R	Dynamic Optimization
ME 575 / CE 575	Optimization Methods

STUDENTS ADVISED

- Jose L. Mojica, M.S., 2013
 - Thesis: A Dynamic Optimization Framework with Model Predictive Control Elements for Long Term Planning of Capacity Investments in a District Energy System
- Ivan Y. Rojas, M.S., 2014
 - Topic: Trajectory Optimization of Unmanned Aerial Vehicles for Oil and Gas Infrastructure Monitoring
- Reza Asgharzadeh Shishavan, Ph.D., 2015
 - Topic: Monitoring and advanced control of upstream energy infrastructure
- Sayed Mostafa Safdarnejad, Ph.D., in progress, estimated 2016
 - Topic: Grid-stability and integration with energy storage and cryogenic carbon capture
- Ammon Eaton, Ph.D., 2017
 - Topic: Advanced monitoring and intelligifield design for oil and gas production
- Logan Beal, Ph.D., 2018
 - Topic: Combined Scheduling and Control
- Brigham Hansen, M.S., 2018
 - Topic: Reservoir optimization with hydraulic artificial lift
- Trent Okeson, M.S., 2018
 - Topic: UAV Infrastructure Monitoring in Cluttered Terrain
- R. Abraham Martin, Ph.D., 2018
 - Topic: Dynamic optimization of UAV mission objectives for infrastructure monitoring
- Nathaniel Gates, M.S., in progress, estimated 2019
 - Topic: Energy optimization of High Altitude, Long Endurance aircraft
- Junho Park, Ph.D., in progress, estimated 2019
 - Topic: Improved Model Support for Drilling Automation
- Cody Simmons, M.S., in progress, estimated 2019
 - Topic: Distributed Energy Systems
- Samuel Arce Munoz, M.S., in progress, estimated 2020
 - Topic: Optimized UAV Route Planning for Autonomous 3D Photogrammetric Inspection

PROFESSIONAL SERVICE AND MEMBERSHIPS

- AIChE CAST Division Executive Committee, Webinar Director, 2013-present
- AIChE UEFA Division Executive Committee, Webinar Director, 2014-present

- AIChE Energy Editorship for Webinar Series, 2013-present
- Associate Editor, MPDI Journal 'Processes', 2016-present
- Committee Member, AACC Control Engineering Practice Award, 2016-present
- Graduate Committee, Chemical Engineering, BYU, 2013-present
- Guest Editor, Control Engineering Practice, 2013
 - Special issue section on Advanced Process Control
- IEEE Control Systems Society, Associate Editor and Conference Editorial Board Member, 2012-2017
 - Conference on Decision and Control
 - American Control Conference
- Public Relations Committee, Chemical Engineering, BYU, 2011-2013
- Reviewer: BYU ORCA grant applications, 2011
- Reviewer: American Control Conference, Applied Energy, Applied Mathematical Modelling, Automatica, Conference on Decision and Control, Control Engineering Practice, DYCOPS (Dynamics and Control of Process Systems), Energy, Energy & Fuels, IFAC, International Federation of Automatic Control, Industrial and Engineering Chemistry Research, International Journal of Hydrogen Energy, International Journal of Robust and Nonlinear Control, Journal of Process Control, Journal of Thermal Science and Engineering Applications, PLOS One, Smart and Sustainable Manufacturing Systems, Springer Optimization Series
- Society of Petroleum Engineers (SPE)
 - Distinguished lecturer (2018-2019)
 - Professional member and student club advisor (2012-present)
- Technical Steering Committee, Clear Gulf Joint Industry Project, 2013-Present
 - Participation from U.S. Congress, NASA, BYU, and oil companies

HONORS AND AWARDS

- Society of Petroleum Engineers, Distinguished Lecturer, 2018-19
- Computing Practice Award, AIChE CAST Division, 2018
- BYU Chemical Engineering, Outstanding Faculty Award, 2016
- BYU Athletic Hall of Fame, 2015
- Himmelblau Award, AIChE CAST Division, 2014
- Thrust 2000 Fellowship Recipient, 2002-2004
- Memorial Scholar Athlete Award, 2001
- NCAA All-American in Cross-Country, 2000
- Kimball Scholar Athlete Award, 2000
- Verizon Academic All-American, 1st Team, 2000
- GTE Academic All-American, 2nd Team, 1999

PEER REVIEWED JOURNAL PUBLICATIONS

1. Hansen, B., Tolbert, B., Vernon, C., **Hedengren, J.D.**, Model Predictive Automatic Control of Sucker Rod Pump System with Simulation Case Study, *Computers & Chemical Engineering*, 121, pp. 263-284, 2019.
2. Blackburn, L., Young, A., Rogers, P., **Hedengren, J.D.**, Powell, K.M., Dynamic Optimization of a District Energy System with Storage Using a Novel Mixed-Integer Quadratic Programming Algorithm, *Optimization and Engineering*, 2019.
3. Freeman, M., Vernon, C., Berrett, B., Hastings, N., Derricott, J., Pace, J., Horne, B., Hammond, J., Janson, J., Chiabrando, F., **Hedengren, J.D.**, Franke, K., Sequential Earthquake Damage Assessment Incorporating Optimized sUAV Remote Sensing at Pescara del Tronto, Special Issue: Remote Sensing Applications for Earthquake and Tsunami Damage Assessment, *Geosciences*, 2019.
4. Okeson, T.J., Barrett, B.J., Arce, S., Vernon, C.A., Franke, K.W., **Hedengren, J.D.**, Achieving Tiered Model Quality in 3D Structure from Motion Models Using a Multi-Scale View-Planning Algorithm for Automated Targeted Inspection, *Sensors*, MDPI, 19 (12), 2703, doi: 10.3390/s19122703, 2019.

5. Martin, R.A., Gates, N., Ning, A., **Hedengren, J.D.**, Dynamic Optimization of High-Altitude Solar Aircraft Trajectories Under Station-Keeping Constraints, *Journal of Guidance, Control, and Dynamics*, 2018, doi: 10.2514/1.G003737.
6. Beal, L.D.R., Hill, D., Martin, R.A., and **Hedengren, J.D.**, GEKKO Optimization Suite, *Processes*, Volume 6, Number 8, 2018, doi: 10.3390/pr6080106.
7. Safdarnejad, S.M., **Hedengren, J.D.**, Powell, K.M., Performance Comparison of Low Temperature and Chemical Absorption Carbon Capture Processes in Response to Dynamic Electricity Demand and Price Profiles, *Applied Energy*, Volume 228, pp. 577-592, 2018, doi:10.1016/j.apenergy.2018.06.098.
8. Beal, L.D., Petersen, D., Grimsman, D., Warnick, S., **Hedengren, J.D.**, Integrated Scheduling and Control in Discrete-time with Dynamic Parameters and Constraints, *Computers & Chemical Engineering*, 115, pp. 361-376, 2018.
9. **Hedengren, J.D.**, Beal, L., Special Issue: Combined Scheduling and Control, *Processes*, 6(3), 24, doi: 10.3390/pr6030024, 2018.
10. Beal, L.D., Petersen D., Pila G., Davis, B., Warnick, S., and **Hedengren, J.D.**, Economic Benefit from Progressive Integration of Scheduling and Control for Continuous Chemical Processes, *Processes*, 5(4), 84, doi:10.3390/pr5040084, 2017.
11. Petersen, D., Beal, L.D., Prestwich D., Warnick, S., and **Hedengren, J. D.**, Combined Noncyclic Scheduling and Advanced Control for Continuous Chemical Processes, *Processes*, 2017, *Processes*, 5(4), 83, doi:10.3390/pr5040083, 2017.
12. Udy, J., Hansen, B., Maddux, S., Peterson, D., Heilner, S., Stevens, K., Lignell, D., **Hedengren, J.D.**, Review of Field Development Optimization of Waterflooding, EOR, and Well Placement Focusing on History Matching and Optimization Algorithms, *Processes*, 5(3), 34, 2017, doi:10.3390/pr5030034.
13. Taysom, S., **Hedengren, J.D.**, Sorensen, C., A Comparison of Model Predictive Control and PID Temperature Control in Friction Stir Welding, *Journal of Manufacturing Processes*, 29, pp. 232-241, 2017, doi: 10.1016/j.jmapro.2017.07.015.
14. Beal, L., Park, J., Petersen, D., Warnick, S., **Hedengren, J.D.**, Combined Model Predictive Control and Scheduling with Dominant Time Constant Compensation, *Computers & Chemical Engineering*, 104, pp. 271-282, 2017, doi: 10.1016/j.compchemeng.2017.04.024.
15. Martin, R.A., Blackburn, L., Pulsipher, J., Franke, K., **Hedengren, J.D.**, Potential Benefits of Combining Anomaly Detection with View Planning for UAV Infrastructure Modeling, 9(5), 434, 2017, doi:10.3390/rs9050434.
16. Mojica, J.L., Petersen, D.J., Hansen, B., Powell, K.M., **Hedengren, J.D.**, Optimal Combined Long-Term Facility Design and Short-Term Operational Strategy for CHP Capacity Investments, *Energy*, Vol 118, 1 January 2017, pp. 97–115.
17. **Hedengren, J.D.**, Eaton, A.N., Overview of Estimation Methods for Industrial Dynamic Systems, *Optimization and Engineering*, Springer, Vol 18 (1), 2017, pp. 155-178, DOI: 10.1007/s11081-015-9295-9.
18. Mojica, J.L., Petersen, D.J., Hansen, B., Powell, K.M., **Hedengren, J.D.**, Optimal Combined Long-Term Facility Design and Short-Term Operational Strategy for CHP Capacity Investments, *Energy*, Vol 118, 1 January 2017, pp. 97–115.
19. Eaton, A.N., Beal, L., Thorpe, S., Hubbell, C., **Hedengren, J.D.**, Nybø, R., Aghito, M., Real Time Model Identification Using Multi-Fidelity Models in Managed Pressure Drilling, *Computers and Chemical Engineering*, 2016, doi:10.1016/j.compchemeng.2016.11.008.
20. Powell, K.M., Kim, J.S., Kapoor, K., Mojica, J.L., **Hedengren, J.D.**, and Edgar, T.F., Thermal Energy Storage to Minimize Cost and Improve Efficiency of a Polygeneration District Energy System in a Real-time Electricity Market, *Energy*, 113, 52–63, 2016, doi:10.1016/j.energy.2016.07.009.
21. Ruggles, S., Clark, J., Franke, K.W., Wolfe, D., Reimschiessel, B., Martin, R.A., Okeson, T.J., **Hedengren, J.D.**, Comparison of SfM Computer Vision Point Clouds of a Landslide Derived from Multiple Small UAV Platforms and Sensors to a TLS based Model, *Journal of Unmanned Vehicle Systems*, 2016, doi:10.1139/juvs-2015-0043.
22. Taysom, S., **Hedengren, J.D.**, Sorensen, C., Dynamic Modeling of Friction Stir Welding for Model Predictive Control, *Journal of Manufacturing Processes*, 23, 165-174, 2016, doi:10.1016/j.jmapro.2016.06.004.

23. Safdarnejad, S.M., **Hedengren, J.D.**, Baxter, L.L, Dynamic Optimization of a Hybrid System of Energy-Storing Cryogenic Carbon Capture and a Baseline Power Generation Unit Applied Energy, *Applied Energy Journal*, 172 (15), 66–79, June 2016, doi:10.1016/j.apenergy.2016.03.074.
24. Powell, K. M., Eaton, A. N., **Hedengren, J. D.**, Edgar, T. F., A Continuous Formulation for Logical Decisions in Differential Algebraic Systems using Mathematical Programs of Complementarity Constraints, *Processes*, 2016, 4(1), 7; doi:10.3390/pr4010007.
25. Safdarnejad, S. M., Gallacher, J. R., **Hedengren, J. D.**, Dynamic Parameter Estimation and Optimization for Batch Distillation, *Computers & Chemical Engineering*, Vol. 86, pp. 18–32, 2016, DOI: 10.1016/j.compchemeng.2015.12.001.
26. Martin, R.A., Rojas, I., Franke, K.W., **Hedengren, J.D.**, Evolutionary View Planning for Optimized UAV Terrain Modeling in a Simulated Environment, *Remote Sensing*, 8(1), 26, 2016, DOI:10.3390/rs8010026.
27. Sun, L., Castagno, J., **Hedengren, J. D.**, and Beard, R. W., Parameter Estimation for Towed Cable Systems Using Moving Horizon Estimation, *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 51, No. 2, April 2015.
28. Asgharzadeh Shishavan, R., Hubbell, C., Perez, H.D., **Hedengren, J.D.**, Pixton, D.S., and Pink, A.P., Multivariate Control for Managed Pressure Drilling Systems Using High Speed Telemetry, *SPE Journal*, SPE-170962, Published Online 7 Oct 2015, DOI: 10.2118/170962-PA.
29. Asgharzadeh Shishavan, R., Hubbell, C., Perez, H.D., **Hedengren, J.D.**, and Pixton, D.S., Combined Rate of Penetration and Pressure Regulation for Drilling Optimization Using High Speed Telemetry, *SPE Drilling & Completion Journal*, SPE-170275-PA, 30 (1), pp. 17-26, 5 March 2015.
30. Lewis, N.R., **Hedengren, J.D.**, Haseltine, E.L., Hybrid Dynamic Optimization Methods for Systems Biology with Efficient Sensitivities, Special Issue on Algorithms and Applications in Dynamic Optimization, *Processes*, 2015, 3(3), 701-729; DOI:10.3390/pr3030701.
31. Safdarnejad, S.M., **Hedengren, J.D.**, Lewis, N.R., Haseltine, E., Initialization Strategies for Optimization of Dynamic Systems, *Computers and Chemical Engineering*, 2015, Vol. 78, pp. 39-50, DOI: 10.1016/j.compchemeng.2015.04.016.
32. Safdarnejad, S.M., **Hedengren, J.D.**, Baxter, L.L, Plant-level Dynamic Optimization of Cryogenic Carbon Capture with Conventional and Renewable Power Sources, *Applied Energy Journal*, Vol. 149, pp. 354-366, 2015, DOI: 10.1016/j.apenergy.2015.03.100.
33. **Hedengren, J.D.**, Asgharzadeh Shishavan, R., Powell, K.M., and Edgar, T.F., Nonlinear Modeling, Estimation and Predictive Control in APMonitor, *Computers and Chemical Engineering*, Volume 70, pg. 133–148, 2014, DOI: 10.1016/j.compchemeng.2014.04.013.
34. Powell, K.M., **Hedengren, J.D.**, and Edgar, T.F., Dynamic Optimization of a Hybrid Solar Thermal and Fossil Fuel System, *Solar Energy*, DOI: 10.1016/j.solener.2014.07.004, Vol. 108, pp. 210–218, 2014.
35. Hallac, B., Keyvanloo, K., **Hedengren, J.D.**, Hecker, W.C., Argyle, M., An Optimized Simulation Model for Iron-Based Fischer-Tropsch Catalyst Design: Transfer Limitations as Functions of Operating and Design Conditions, *Chemical Engineering Journal*, Available online 8 November 2014, ISSN 1385-8947, <http://dx.doi.org/10.1016/j.cej.2014.10.108>, 2014.
36. Sun, L., **Hedengren, J.D.**, and Beard, R.W., Optimal Trajectory Generation using Model Predictive Control for Aerially Towed Cable Systems, Accepted to *Journal of Guidance, Control, and Dynamics*, Vol. 37, Issue 2, pp. 525-539, 2014.
37. Kelly, J. D. and **Hedengren, J.D.**, A Steady-State Detection (SSD) Algorithm to Detect Non-Stationary Drifts in Processes, *Journal of Process Control*, 23, 3, pp. 326–331, March 2013.
38. Spivey, B.J., **Hedengren, J.D.** and Edgar, T.F., Constrained Nonlinear Estimation for Industrial Process Fouling, *Industrial & Engineering Chemistry Research*, 49 (17), pp 7824–7831, DOI: 10.1021/ie9018116, 2010.
39. **Hedengren, J.D.** and Edgar, T.F., Approximate Nonlinear Model Predictive Control with In Situ Adaptive Tabulation, *Computers and Chemical Engineering*, Volume 32, pp. 706-714, 2008.
40. **Hedengren, J.D.** and Edgar, T.F., In Situ Adaptive Tabulation for Real-Time Control, *Industrial & Engineering Chemistry Research*, Ind. Eng. Chem. Res., Volume 44, Issue 8, pp. 2716 -2724, 2005.
41. **Hedengren, J.D.** and Edgar, T.F., Order Reduction of Large Scale DAE Models, *Computers and Chemical Engineering*, Volume 29, Issue 10, pp. 2069-2077, 2005.

PEER REVIEWED CONFERENCE PROCEEDINGS

1. Pastusek, P., Payette, G., Shor, R., Cayeux, E., Aarsnes, U.J., **Hedengren, J.D.**, Menand, S., Macpherson, J., Gandikota, R., Behounek, M., Harmer, R., Detournay, E., Illerhaus, R., Liu, Y., Creating Open Source Models, Test Cases, and Data for Oilfield Drilling Challenges, SPE/IADC Drilling Conference, The Hague, Netherlands, March 2019, SPE-194082-MS.
2. Tubbs, B., **Hedengren, J.D.**, Data-Driven Operations Management and Production Optimization, Operations: Case Studies and Best Practices, Canadian Institute Of Mining Metallurgy And Petroleum Conference Convention, CIM Convention, Montréal, CA, 2019.
3. Gates, N.S., Moore, K.R., Ning, A., **Hedengren, J.D.**, Combined Trajectory, Propulsion and Battery Mass Optimization for Solar-Regenerative High-Altitude Long Endurance Unmanned Aircraft, AIAA Science and Technology Forum (SciTech), 2019.
4. Rossiter, J.A., Jones, B.L., Pope, S., **Hedengren, J.D.**, Evaluation and Demonstration of Take Home Laboratory Kit, Invited Session: Demonstration and poster session, 12th IFAC Symposium on Advances in Control Education, July 7-9, 2019, Philadelphia, PA, USA.
5. Oliveira, P.M., **Hedengren, J.D.**, An APMonitor Temperature Lab PID Control Experiment for Undergraduate Students, 24th IEEE Conference on Emerging Technologies and Factory Automation (ETFA), Sep 10th - 13th, 2019, Zaragoza, Spain.
6. **Hedengren, J.D.**, Brower, D.V., Wilson J.C., High, G., Witherow, K., Distributed Fiber Optic Strain Monitoring During Deployment Of A Deepwater Subsea Umbilical, Symposium 4 Pipelines, Risers, and Subsea Systems, ASME 38th International Conference on Ocean, Offshore and Arctic Engineering, OMAE2019/95558, Glasgow, Scotland, UK, June 2019.
7. Brower, D.V., Bentley, N.L., **Hedengren, J.D.**, Kipp, R.M., Le, S.Q., Seaman, C., Tang, H.H., Wilson, J.C., Full-Scale Testing of a Friction-Based, Post-Installable, Fiber-Optic Strain Sensor for Subsea Monitoring Systems, Topic: 4-6 Innovative Technologies for Deepwater Low-Cost Production, Symposium 4 Pipelines, Risers, and Subsea Systems, ASME 37th International Conference on Ocean, Offshore and Arctic Engineering, OMAE2018/77117, Madrid, Spain, June 2018.
8. **Hedengren, J.D.**, Brower, D.V., Wilson J.C., High, G., Witherow, K., New Flow Assurance System With High Speed Subsea Fiber Optic Monitoring Of Pressure And Temperature, Symposium 4 Pipelines, Risers, and Subsea Systems, ASME 37th International Conference on Ocean, Offshore and Arctic Engineering, OMAE2018/78079, Madrid, Spain, June 2018.
9. Martin, R.A., Heiner, B., **Hedengren, J.D.**, Targeted 3D Modeling from UAV Imagery, SPIE Defense + Security Symposium, Geospatial Informatics, and Motion Imagery Analytics VIII, 15 - 19 April 2018, Orlando, Florida.
10. Aghito, M., Bjørkevoll, K.S., Nybø, R., Eaton, A., **Hedengren, J.D.**, Automatic Model Calibration for Drilling Automation, SPE Bergen One Day Seminar, Bergen, Norway, 5 April 2017.
11. Beal, L., Clark, J., Anderson, M., Warnick, S., **Hedengren, J.D.**, Combined Scheduling and Control with Diurnal Constraints and Costs using a Discrete Time Formulation, FOCAPO / CPC 2017, Tuscon, AZ, Jan 2017.
12. Udy, J., Blackburn, L., **Hedengren, J.D.**, Darby, M., Reduced Order Modeling for Reservoir Injection Optimization and Forecasting, FOCAPO / CPC 2017, Tuscon, AZ, Jan 2017.
13. Franke, K., Nguyen, T., Shao, L., Bender, C., Wolfe, D., **Hedengren, J.D.**, Reimschiessel, B., The Use of Unmanned Aerial Vehicles (UAVs) and Structure from Motion (SfM) to Measure Volume Change at a Deep Dynamic Compaction Site, Geotechnical Frontiers, March 12-15, 2017, Orlando, Florida.
14. Park, J., Webber, T.R., Asgharzadeh Shishavan, R., **Hedengren, J.D.**, Improved Bottomhole Pressure Control with Wired Drillpipe and Physics-Based Models, SPE-184610-MS, SPE/IADC Drilling Conference and Exhibition, The Hague, The Netherlands, 14-16 March 2017.
15. Eaton, A., Beal, L., Thorpe, S.D., Janis, E.H., Hubbell, C., **Hedengren, J.D.**, Nybø, R., Aghito, M., Bjørkevoll, K., El Boubsi, R., Braaksma, J., and van Og, G., Ensemble Model Predictive Control for Robust Automated Managed Pressure Drilling, SPE Annual Technical Conference and Exhibition (ATCE), SPE-174969-MS, Houston, TX: 28-30 Sept 2015.

16. Eaton, A., Safdarnejad, S.M., **Hedengren, J.D.**, Moffat, K., Hubbell, C., Brower, D.V., Brower, A.D., Post-Installed Fiber Optic Pressure Sensors on Subsea Production Risers for Severe Slugging Control, ASME 34th International Conference on Ocean, Offshore and Arctic Engineering, OMAE2014/42196, St. John's, Newfoundland, Canada, June 2015.
17. Palmer, L.M., Franke, K.W., Martin, R.A., Sines, B.E., Rollins, K.M., **Hedengren, J.D.**, Application and accuracy of structure from motion computer vision models with full-scale geotechnical field tests. Proceedings, 2015 International Foundation Congress and Equipment Expo, Paper 301, ASCE, Reston, VA, 2015.
18. Sugiura, J., Samuel, R., Oppelt, J., Ostermeyer, G.P., **Hedengren, J.D.**, and Pastusek, P., Drilling Modeling and Simulation: Current State and Future Goals, SPE IADC Drilling Conference and Exhibition, SPE-173045, 17-19 March 2015, UK, London. [Conference Web-site](#)
19. Pixton, D., Asgharzadeh Shishavan, R., **Hedengren, J.D.**, Craig, A., Addressing UBO and MPD Challenges with Wired Drillpipe, SPE/IADC MPD & UBO Conference & Exhibition, Madrid, Spain: 8 - 9 Apr 2014. [Conference Web-site](#)
20. Asgharzadeh Shishavan, R., Brower, D.V., **Hedengren, J.D.**, Brower, A.D., New Advances in Post-Installed Subsea Monitoring Systems for Structural and Flow Assurance Evaluation, OMAE2014/24300, San Francisco, CA, June 2014. [Publication Link](#)
21. Brower, D., **Hedengren, J.D.**, Asgharzadeh Shishavan, R., and Brower, A., Advanced Deepwater Monitoring System, OMAE2013/10920, Nantes, France, June 2013, ISBN: 978-0-7918-5531-7. [Publication Link Presentation](#)
22. Brower, D.V., Brower, A.D., **Hedengren, J.D.**, Asgharzadeh Shishavan, R., A Post-Installed Subsea Monitoring System for Structural and Flow Assurance Evaluation, Offshore Technology Conference, OTC 25368, Houston, TX, May 2014.
23. Jacobsen, L. T. and **Hedengren, J. D.**, Model Predictive Control with a Rigorous Model of a Solid Oxide Fuel Cell, American Control Conference (ACC), Washington, DC, pp. 3747–3752, 2013. [Publication Link Presentation](#)
24. Powell, K. M., **Hedengren, J. D.**, and Edgar, T. F., Dynamic Optimization of a Solar Thermal Energy Storage System over a 24 Hour Period using Weather Forecasts, American Control Conference (ACC), Washington, DC, pp. 2952-2957, 2013. [Publication Link](#)
25. Spivey, B.J., **Hedengren, J.D.**, and Edgar, T.F., Constrained Control and Optimization of Tubular Solid Oxide Fuel Cells for Extending Cell Lifetime, American Control Conference (ACC), Montréal, Canada, pp. 1356-1361, July 2012. [Publication Link](#) | [Presentation](#)
26. Brower, D., **Hedengren, J.D.**, Loegering, C., Brower, A., Witherow, K., and Winter, K., Fiber Optic Monitoring of Subsea Equipment, OMAE 2012, Rio de Janeiro, Brazil, Volume 1: Offshore Technology, Number: 84143, pp. 769-776, June 2012. [Publication Link](#) | [Presentation](#)
27. **Hedengren, J.D.**, Allsford, K.V., and Ramlal, J., Moving Horizon Estimation and Control for an Industrial Gas Phase Polymerization Reactor, Proceedings of the American Control Conference (ACC), New York, NY, pp. 1353-1358, July 2007. [Publication Link](#)
28. **Hedengren, J. D.** and Edgar, T. F., Moving Horizon Estimation - The Explicit Solution, Proceedings of the CPC-VII, Lake Louise, Alberta, Canada, 2006. [Publication Link](#)
29. **Hedengren, J.D.** and Edgar, T.F., Order Reduction of Large Scale DAE Models, IFAC 16th World Congress, Prague, Czechoslovakia, July, 2005. [Publication Link](#)
30. **Hedengren, J. D.** and Edgar, T. F., In Situ Adaptive Tabulation for Real-time Control, Proceedings of the American Control Conference (ACC), Boston, MA, pp. 2222-2227, July 2004. [Publication Link](#) | [Presentation](#)

PATENTS

1. Lawson, K. W., **Hedengren, J. D.**, Smith, L. C., Method for Controlling Bubble Formation in Polymerization Reactors, [International Patent WO2012005740](#), Issued January 12, 2012, [United States Patent Application 20130203946](#), Issued August 8, 2013.
2. Ross, K., **Hedengren, J.D.**, and Sorensen, C.A., Process Control of Plunge and Initial Traverse in Friction Stir Processing, Provisional Patent, filed with the U.S. Patent Office on March 2012.

INVITED PRESENTATIONS AND CONTRIBUTIONS

1. **Hedengren, J.D.**, Drilling Automation and Downhole Monitoring with Physics-based Models. Society of Petroleum Engineers Distinguished Lecturer, Visits to: (*Jan 2018*) Salt Lake Section, Salt Lake City, Utah, (Sept 2018) Oklahoma City Section: Oklahoma City, Oklahoma, Southwest Oklahoma Section: Duncan, Oklahoma, Dallas Section: Dallas, Texas, Southwest Texas Section: Corpus Christi, Texas (*Feb 2019*) Bergen Section: Bergen, Norway, Copenhagen Section: Copenhagen, Denmark, German Section: Hanover, Germany, Ivano-Frankivsk Section: Ivano-Frankivsk, Ukraine, Timan-Pechora Section: Ukhta, Russia, Northwest Russia Section: St. Petersburg, Russia, Perm Section: Perm, Russia, Tyumen Section: Tyumen, Russia (*Apr 2019*) Vietnam Section: Ho Chi Minh City, Vietnam, Korea Section: Seoul, South Korea, Chengdu Study Group Section: Chengdu, China, Bangalore Section: Bangalore, India, Mumbai Section: Mumbai, India (*June 2019*) Hassi Messaoud Section: Hassi Messaoud, Algeria, Baghdad Section: Baghdad, Iraq, Basra Section: Basrah, Iraq, Erbil Section: Erbil, Iraq.
2. **Hedengren, J.D.**, Combined Scheduling and Control. Invited talk at the University of Wisconsin-Madison, Sept 2017.
3. Incorporating Dynamic Simulation into Chemical Engineering Curricula, **Hedengren, J.D.**, Badgwell, T.A., Grover, M., Braatz, R., ASEE Summer School for New Chemical Engineering Faculty, Raleigh, North Carolina, July 2017.
4. **Hedengren, J.D.**, Combined Scheduling, Design, and Control. Invited talk at Lund University, Lund, Sweden, Nov 2016.
5. **Hedengren, J.D.**, Ensemble Model Predictive Control for Robust Automated Managed Pressure Drilling, Invited talk at NTNU (Norwegian University of Science and Technology), Trondheim, Norway, Feb 2016.
6. **Hedengren, J.D.**, Combined Scheduling and Control, Invited talk at CMU (Carnegie Mellon University), Pittsburgh, PA, Oct 2015.
7. Mojica, J.L. and **Hedengren, J.D.**, APMonitor: Modeling Platform for Dynamic Optimization, Invited Session on Optimization Modeling Languages and Software at APMOD 2014, 11th International Conference on Applied Mathematical Optimization and Modelling, 9-11 April 2014, Warwick Business School, Coventry, UK. [Abstract](#)
8. **Hedengren, J.D.**, Dynamic Data Reconciliation and Optimization, Invited talk at University of Utah, Salt Lake City, UT, Oct 2013.
9. **Hedengren, J.D.**, Dynamic Data Reconciliation and Optimization, Invited Lecture at the University of Utah, Graduate Seminar, 30 Oct 2013. [Presentation](#)
10. **Hedengren, J.D.**, Dynamic Optimization Across Disciplines, Invited Lecture at Oklahoma State University, Graduate Seminar, 17 Sept 2013. [Abstract](#) [Presentation](#)
11. Mojica, J.L., Greenquist, I., **Hedengren, J.D.**, Dynamic Optimization: Energy System Planning Under Uncertainty, INEST Nuclear Hybrid Energy Systems CORE Workshop, Idaho Falls, ID, July 2013. [Presentation](#)
12. Greenquist, I., **Hedengren, J.D.**, Opportunities for Hybrid Nuclear System Integration in the Petrochemical Industry, INEST Nuclear Hybrid Energy Systems CORE Workshop, Idaho Falls, ID, July 2013. [Poster](#)
13. **Hedengren, J.D.**, Monitoring Energy Infrastructure, Invited Session, Clear Gulf Joint Industry Project Review Meeting, Johnson Space Center, Houston, TX, April 2013.
14. **Hedengren, J.D.**, APMonitor Modeling Language for Mixed-Integer Differential Algebraic Systems, Computing Society Sponsored Session on Optimization Modeling Software: Design and Applications, INFORMS Annual Meeting, Phoenix, AZ, Oct 2012. [Abstract](#) | [Session](#) | [Presentation](#)
15. **Hedengren, J. D.**, A Nonlinear Model Library for Dynamics and Control, Computer Aids for Chemical Engineering (CACHE) News, Invited Feature Article, Summer 2008. [Link](#)
16. Invited Contributor to: Beucher, O. and M. Weeks, Introduction to MATLAB & SIMULINK: A Project Approach, 3rd Edition, Infinity Science Press, 2008.

CONFERENCE PAPERS AND PRESENTATIONS

1. Park, J., Hansen, B., Gates, N., Darby, M., **Hedengren, J.D.**, Use of Nonlinear and Machine Learning Techniques for Improved APC Modeling, AIChE Spring Meeting, New Orleans, LA, April 2019. [Abstract](#)

2. Park, J., Patterson, C., Kelly, J., **Hedengren, J.D.**, Closed-Loop PID Re-Tuning in a Digital Twin By Re-Playing Past Setpoint and Load Disturbance Data, AIChE Spring Meeting, New Orleans, LA, April 2019.
3. Blackburn, L., **Hedengren, J.D.**, Powell, K.M., Real-time Optimization of Chillers with Thermal Energy Storage and Variable Electricity Rates, Smart City & Sustainable Communities, INFORMS 2018 Annual Meeting, Phoenix, AZ, USA, Nov. 4-7, 2018.
4. Okeson, T., Barrett, B., Blackburn, L., **Hedengren, J.D.**, Franke, K., Optimized Infrastructure Monitoring: 3D Modeling in Complex Environments, Center for Unmanned Aircraft Systems (C-UAS), Atlanta, GA, 8 Feb 2017.
5. Eaton, A.N., Park, J., Thorpe, S., Webber, T., Safdarnejad, S.M., **Hedengren, J.D.**, High-Speed Data and High-Fidelity Models: Opportunities and Challenges in Well Manufacturing, AIChE Spring Meeting, Houston, TX, April 2016.
6. Safdarnejad, S.M., Richards, J., Griffiths, J., **Hedengren, J.D.**, Baxter, L.L., Increased Stability of a Power Grid by Energy Storage of Cryogenic Carbon Capture, AIChE Spring Meeting, Houston, TX, April 2016.
7. Nikbakhsh, S., **Hedengren, J.D.**, Darby, M., Udy, J., Constrained Model Identification Using Open-Equation Nonlinear Optimization, AIChE Spring Meeting, Houston, TX, April 2016.
8. Martin, R.M., Hall, A., Brinton, C., Franke, K., and **Hedengren, J.D.**, Privacy Aware Mission Planning and Video Masking for UAV Systems, UMS-01, Unmanned Systems: Mission Management and Planning Technologies, Jan 4, 2016, AIAA Infotech at Aerospace, AIAA Science and Technology Forum and Exposition 2016, San Diego, California, USA, 4-8 Jan 2016.
9. Safdarnejad, S.M., **Hedengren, J.D.**, Baxter, L.L., Dynamic Optimization of the Hybrid System of a Baseline Power Generation Unit and Cryogenic Carbon Capture, Western Section of the Combustion Institute, Fall 2015 Meeting, Provo, UT, October 5-6, 2015.
10. Eaton, A.N., Beal, L., Janis, E., Hubbell, C., **Hedengren, J.D.**, Nybø, R., Aghito, M., Bjørkevoll, K., Addressing Control Challenges of Discontinuous Processes with Multi-Fidelity Model Predictive Control, Modeling, Control and Optimization of Energy Systems II, AIChE Annual Meeting, Salt Lake City, UT, Nov 2015.
11. Park, J., Safdarnejad, M., Asgharzadeh Shishavan, R., **Hedengren, J.D.**, Rastegar, R., Snell, A., Nonlinear Model Predictive Control of Managed Pressure Drilling Based on Hammerstein-Wiener Piecewise Linear Models, AIChE Annual Meeting, Salt Lake City, UT, Nov 2015.
12. Safdarnejad, M., Gallacher, J., **Hedengren, J.D.**, Baxter, L.B., A New Framework for Dynamic Parameter Estimation and Optimization of Batch Distillation Columns, AIChE Annual Meeting, Salt Lake City, UT, Nov 2015.
13. Safdarnejad, M., **Hedengren, J.D.**, Baxter, L.B., Reduction in Cycling of the Boilers By Using Large-Scale Energy Storage of Cryogenic Carbon Capture, AIChE Annual Meeting, Salt Lake City, UT, Nov 2015.
14. Franke, K., **Hedengren, J.D.** and Farrell, R., UAS-Based Infrastructure Monitoring, Center for Unmanned Aircraft Systems (C-UAS), Arlington, VA, Feb 2015.
15. Asgharzadeh Shishavan, R. and **Hedengren, J.D.**, Improved Estimator Insensitivity to Outliers, Measurement Drift, and Noise, AIChE Spring Meeting, New Orleans, LA, April 2014. [Abstract](#)
16. Asgharzadeh Shishavan, R., Memmott, J.A., **Hedengren, J.D.**, and Pixton, D., Pressure Regulation and Kick Attenuation with Wired Pipe Technology in Managed Pressure Drilling, AIChE Spring Meeting, New Orleans, LA, April 2014. [Abstract](#)
17. Brower, D., Brower, A., Memmott, J.A., Asgharzadeh Shishavan, R., and **Hedengren, J.D.**, Advanced Monitoring Systems on Existing Deepwater Infrastructure for Intelli-Field Advances, AIChE Spring Meeting, New Orleans, LA, April 2014. [Abstract](#)
18. Mojica, J.L., Chen, M., Petersen, D., **Hedengren, J.D.**, Planning of Capacity Investments using a Model Predictive Control Approach, INFORMS Annual Meeting, Minneapolis, MN, Oct 2013. [Abstract](#) | [Session](#) | [Presentation](#)
19. **Hedengren, J.D.**, Mojica, J.L., Lewis, A.D. and Nikbakhsh, S., MINLP with Combined Interior Point and Active Set Methods, INFORMS Annual Meeting, Minneapolis, MN, Oct 2013. [Abstract](#) | [Session](#) | [Presentation](#)
20. **Hedengren, J.D.** and Franke, K., Infrastructure Monitoring: Displacement Detection with Optical Sensors, Center for Unmanned Aircraft Systems (C-UAS), Snowbird, UT, Aug 2013. [Presentation](#)
21. Martin, R.A., Pulsipher, J., Lund, C., Clark, J., **Hedengren, J.D.**, and Franke, K., UAV-Based Infrastructure Monitoring, Poster Session: Center for Unmanned Aircraft Systems (C-UAS), Snowbird, UT, Aug 2013. [Poster 1](#) [Poster 2](#)

22. **Hedengren, J.D.**, Mojica, J.L., Asgharzadeh Shishavan, R., Safdarnejad, S.M., Recent Advances in the Application of MDAE Systems, AIChE National Meeting, San Francisco, CA, Nov 2013. [Abstract](#)
23. Mojica, J.L., **Hedengren, J.D.**, A Model Predictive Control Approach for Long Term Planning of Capacity Investments in a District Heating System, AIChE National Meeting, San Francisco, CA, Nov 2013. [Abstract](#)
24. Abbott, C.S., Haseltine, E.L., Martin, R.A., and **Hedengren, J.D.**, New Capabilities for Large-Scale Models in Computational Biology, Computing and Systems Technology Division, AIChE National Meeting, Pittsburgh, PA, Oct 2012. [Session](#) | [Abstract](#)
25. Asgharzadeh Shishavan, R. and **Hedengren, J.D.**, Nonlinear Model Predictive Control of a Thermal Oxidizer System, Computing and Systems Technology Division, AIChE National Meeting, Pittsburgh, PA, Oct 2012. [Session](#) | [Abstract](#)
26. Powell, K.M., **Hedengren, J.D.**, and Edgar, T.F., Dynamic Optimization of Solar Thermal Systems with Storage, Computing and Systems Technology Division, AIChE National Meeting, Pittsburgh, PA, Oct 2012. [Session](#) | [Abstract](#)
27. **Hedengren, J.D.**, Mojica, J.L., Cole, W., Edgar, T.F., APOPT: MINLP Solver for Differential Algebraic Systems with Benchmark Testing, INFORMS Annual Meeting, Phoenix, AZ, Oct 2012. [Abstract](#) | [Session](#) | [Presentation](#)
28. Liang Sun, **Hedengren, J.D.**, Beard, R.W., Real-time Moving Horizon Estimation for an Unmanned Aerial System, OPTEC Workshop on Moving Horizon Estimation and System Identification, Leuven, Belgium, Aug 2012. [Abstract](#)
29. **Hedengren, J.D.**, A Simulation Platform to Enhance Engineering Laboratory Experiences, ASEE: American Society for Engineering Education, Summer School, Orono, Maine, July 2012. [Abstract](#) | [Poster](#)
30. Jensen, K.R. and **Hedengren, J.D.**, Improved Load Following of a Boiler with Advanced Process Control, AIChE Spring Meeting, Houston, TX, April 2012. [Abstract](#) | [Presentation](#)
31. **Hedengren, J.D.**, Brower, D., and Mojica, J., Advanced Process Monitoring of Flow Assurance with Fiber Optics, AIChE Spring Meeting, Houston, TX, April 2012. [Abstract](#) | [Presentation](#)
32. Soderstrom, T.A., Zhang, Y., and **Hedengren, J.D.**, Advanced Process Control in ExxonMobil Chemical Company: Successes and Challenges, CAST Division, AIChE National Meeting, Salt Lake City, UT, Nov 2010. [Presentation](#)
33. Spivey, B.J., **Hedengren, J.D.**, and Edgar, T.F., Monitoring of Process Fouling Using First-Principles Modeling and Moving Horizon Estimation, Proc. Applications of Computer Algebra (ACA) Conference, Montréal, Canada, 2009.
34. Spivey, B.J., **Hedengren, J.D.**, and Edgar, T.F., Monitoring of Process Fouling Using First-Principles Modeling and Moving Horizon Estimation, Proc. Texas, Wisconsin, California Control Consortium (TWCCC), Austin, TX, February 2009.
35. Ramlal, J., Naidoo, V., Allsford, K.V., and **Hedengren, J.D.**, Moving Horizon Estimation for an Industrial Gas Phase Polymerization Reactor, Proc. IFAC Symposium on Nonlinear Control Systems Design (NOLCOS), Pretoria, South Africa, 2007. [Publication Link](#)
36. **Hedengren, J.D.** and Edgar, T.F., Order Reduction of a Large-Scale Index-2 DAE Model, Computing and Systems Technology Division, AIChE National Meeting, Cincinnati, OH, Nov 2005.
37. **Hedengren, J. D.** and Edgar, T. F., Efficient Moving Horizon Estimation of DAE Systems, Texas-Wisconsin Modeling and Control Consortium (TWMCC), Austin, TX, Feb 2005.
38. **Hedengren, J. D.** and Edgar, T. F., Adaptive DAE Model Reduction, Texas-Wisconsin Modeling and Control Consortium (TWMCC), Madison, WI, Sept 2004.
39. **Hedengren, J. D.** and Edgar, T. F., Order Reduction of Large Scale DAE Models, Computing and Systems Technology Division, AIChE National Meeting, Austin, TX, Nov 2004.
40. **Hedengren, J. D.** and Edgar, T. F., Dependency Analysis for DAE to ODE Conversion and Model Reduction, Texas-Wisconsin Modeling and Control Consortium (TWMCC), Austin, TX, Feb 2004.
41. **Hedengren, J. D.**, In Situ Adaptive Tabulation for Real-time Control, Admission to Candidacy, 9 Dec. 2003 - Himmelblau Library (CPE 4.446).
42. **Hedengren, J. D.** and Edgar, T. F., In Situ Adaptive Tabulation for Nonlinear MPC, Poster Session: Systems and Process Control, AIChE National Meeting, San Francisco, CA, Nov 2003.
43. **Hedengren, J. D.** and Edgar, T. F., In Situ Adaptive Tabulation for Nonlinear MPC, Texas-Wisconsin Modeling and Control Consortium (TWMCC), Madison, WI, Sept 2003.

44. **Hedengren, J. D.**, Beckstead, M. W., and Spinti, J., Implementation of Automatically Simplified Chemical Kinetics through Intrinsic Low-Dimensional Manifolds for Gaseous HMX, Joint Army-Navy-NASA-Air Force (JANNAF) 20th Propulsion Systems Hazards Subcommittee (PSHS), 38th JANNAF Combustion Subcommittee Meeting, and 2nd Modeling and Simulation Subcommittee Meeting, Destin, FL, Apr 2002. [Publication Link](#)