

Karen E. Willcox, MNZM, PhD
Director, Oden Institute for Computational Engineering and Sciences
Professor of Aerospace Engineering and Engineering Mechanics
W. A. "Tex" Moncrief, Jr. Chair in Simulation-Based Engineering and Sciences
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Education

1994 University of Auckland, Bachelor of Engineering, First Class Honours (Engineering Science)
1996 Massachusetts Institute of Technology, Master of Science (Aeronautics and Astronautics)
 Thesis: *Aeroelastic Computations in the Time Domain using Unstructured Meshes*
2000 Massachusetts Institute of Technology, PhD (Aeronautics and Astronautics)
 Thesis: *Reduced-Order Aerodynamic Models for Aeroelastic Control of Turbomachines*

Experience

University of Texas at Austin

2018-present Director, Oden Institute for Computational Engineering and Sciences
2018-present Professor of Aerospace Engineering and Engineering Mechanics

Santa Fe Institute

2019-present External Professor

Massachusetts Institute of Technology

2001-2018 Professor, Aeronautics and Astronautics
2011-2013 Associate Department Head, Aeronautics and Astronautics
2008-2018 Founding Co-Director, MIT Center for Computational Engineering

Singapore University of Technology and Design

2011, 2015, 2018 Visiting Professor (3 x 6-month stay)

University of Auckland, New Zealand

2008-2009 Visiting Associate Professor, Department of Engineering Science (15-month stay)
2015 Visiting Professor, Department of Engineering Science (8-month stay)

Sandia National Laboratories

2005 Visiting Researcher, Computer Science Research Institute (5-month stay)

Stanford University

2005 Visiting Scholar (1-month stay)

Boeing Phantom Works

2000-2001 Visiting Researcher, Blended-Wing-Body Aircraft Design Group (1-year stay)

NASA Dryden Flight Research Center

1996 Aerospace Intern, Aerodynamics Branch

Professional Interests

Research: Data to decisions in engineering systems. Computational models and methods for design, optimization, control and uncertainty quantification of engineering systems. Predictive data science. Reduced-order modeling and multi-fidelity methods. Future aircraft technologies, aircraft system optimization, aircraft environmental impact, multidisciplinary design, unmanned aerial vehicles, Digital Twin, Digital Thread.

Education: EdTech for data visualization, modeling and analytics (mapping.mit.edu). Fly-by-Wire intervention to enable scalable differentiated instruction in community colleges (fbw.mit.edu). Mapping learning outcomes across the undergraduate engineering curriculum (xoces.mit.edu); linking topics across the curriculum (crosslinks.mit.edu).

Teaching: Principles of Automatic Control (undergraduate), Computational Methods in Aerospace Engineering (undergraduate), Signals and Systems (undergraduate), Multidisciplinary System Design Optimization (graduate), Flight Vehicle Aerodynamics (graduate), Numerical Methods for Partial Differential Equations (graduate).

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Professional Memberships

Fellow, American Institute of Aeronautics and Astronautics (AIAA)

Fellow, Society for Industrial and Applied Mathematics (SIAM)

Member, American Society for Engineering Education (ASEE)

Visiting Committees and Review Boards

Review Committee, Research Assessment of Aerospace Engineering, Delft University of Technology (2020)

Committee to Visit Harvard University Information Technology (Member, 2019)

National Academies Panel on Review of the Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST) (2018)

External Review Board, Computing and Information Sciences Research Foundation, Sandia National Laboratories (Member, 2016 – present)

Visiting Committee, Applied Mathematics & Statistics Department, Colorado School of Mines (Member, 2017)

HarvardX Review Committee, Harvard University (Member, 2016)

Board of Visitors, Institute for Computational Engineering and Sciences, University of Texas at Austin (2012 – 2018; Chair 2015 – 2018)

Assessment Committee, Accreditation of Aerospace Engineering, Delft University of Technology (2013)

Committee of Visitors, Division of Mathematical Sciences, National Science Foundation (Member, 2010)

External Boards and Committees

Department of Energy Working Group on Basic Research Needs for Scientific Machine Learning (2017 – 2019)

National Academies Planning Committee on the Workshop on the Frontiers of Mechanistic Data-Driven Modeling for Additive Manufacturing (2019)

National Academies Committee to Assess the Risks of Unmanned Aircraft Systems (UAS) Integration (2017 – 2018)

National Academies Board on Mathematical Sciences and Analytics (BMSA) (2016 – present)

SIAM Journals Committee (2019 – present)

SIAM Committee on Science Policy (2016 – 2018)

SIAM Activity Group on Computational Science and Engineering: Vice President (2013 – 2015), Program Director (2011 – 2013)

Co-Chair, SIAM 2013 Conference on Computational Science and Engineering

Co-Chair, Institute-wide Task Force on the Future of MIT Education (2013 – 2014)

MIT OpenCourseWare Faculty Advisory Committee (2011 – 2018; Chair 2015 – 2018)

National Research Council, Committee to Conduct an Independent Assessment of the Nation's Wake Turbulence Research and Development Program (2007)

National Academies Decadal Survey of Civil Aeronautics, Aerodynamics and Acoustics Panel (2005 – 2006)

AIAA Multidisciplinary Design Optimization (MDO) Technical Committee (2001 – present); Chair (2019 – 2021); Vice-Chair (2017 – 2019); Awards Subcommittee Chair (2003 – 2006); Publications Subcommittee Chair (2011 – 2018); MDO Conference Technical Chair (2011 – 2012)

Advisory Boards

Advisory Board, Center of Excellence on Sustainable and Energy Efficient Aviation, TU Braunschweig (2020 — present)

National Science Foundation Advisory Committee for Cyberinfrastructure (2019 – present)

Science Board, Santa Fe Institute (2019 – present)

External Advisory Board, Michigan Institute for Computational Discovery and Engineering, University of Michigan (Member, 2017 – present)

Advisory Board, Girls' Angle (2014 – present)

Advisory Board, Department of Engineering Science, University of Auckland (Member, 2008 – present)

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Editorial Boards

Journal on Data Centric Engineering (Advisory Board 2019 – present)

SIAM Journal on Scientific Computing (Section Editor, 2013 – 2019; Associate Editor, 2008 – 2013)

AIAA Journal (Associate Editor, 2015 – present, 2009 – 2011)

ASA/SIAM Journal on Uncertainty Quantification (Associate Editor, 2012 – 2013)

SIAM Book Series on Computational Science and Engineering (Editorial Board Member, 2009 – present)

Selected Awards and Honors

Southwest Research Institute Best Student Paper Award (M. Kapteyn), “Toward predictive digital twins via component-based reduced-order models and interpretable machine learning,” AIAA Non-Deterministic Approaches Conference, Scitech Forum, 2020.

AIAA Fellow, Class of 2019

SIAM Fellow, Class of 2018

NeurIPS paper “Contour location via entropy reduction leveraging multiple information sources” selected for Spotlight Presentation (3% of submissions), 2018.

Best Paper Award, “Towards a Low-Order Model for Transonic Flutter Prediction,” AIAA Theoretical Fluid Mechanics Conference, AIAA Aviation Forum, 2017

Member of the New Zealand Order of Merit, 2017

Distinguished Alumni Award, University of Auckland, 2016

Member, Harvard Higher Education Leaders Forum, 2016 – present

SIAM SIGEST Award for paper “Goal-oriented inference: Approach, linear theory, and application to advection-diffusion,” 2013

Sir Peter Blake Trust Emerging Leader Award, 2010

Selected for National Academies Frontiers of Engineering Education Symposium, 2010

AIAA MDO Technical Committee Service Award, 2008 and 2013

J. T. Oden Faculty Research Fellow, University of Texas at Austin, 2006

New Zealand Management Magazine, Young Leader, 2006

MIT Junior Bose Teaching Award, 2005

MIT Department of Aeronautics and Astronautics Teaching Award, 2004

Best Paper Award, “A Framework for Aircraft Conceptual Design and Environmental Performance Studies,” AIAA Multidisciplinary Analysis and Optimization Conference, 2004

Leadership Activities

Academic: Given well over 100 invited lectures in the US and internationally, including multiple keynote talks at major international conferences. Published over 100 papers in refereed archival journals. Supervised theses for 53 graduate students (34 S.M., 19 PhD). Secured funding and managed multi-institutional research projects from many sources including the U.S. Air Force, Boeing, U.S. Department of Energy, Federal Aviation Administration, NASA, National Science Foundation, DARPA, and U.S. Department of Education.

Major multi-institution research grants as lead include: Co-lead PI and Co-Director, AEOLUS Multifaceted Mathematics Capability Center on Advances in Experimental Design, Optimal Control, and Learning for Uncertain Complex Systems (Department of Energy, \$10M total budget over 4 years). Lead PI, Multidisciplinary University Research Initiative

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(MURI) project on Managing Multiple Information Sources of Multi-physics Systems (Air Force Office of Scientific Research, \$7.2M total budget over 5 years). Co-lead PI and Co-Director, DiaMonD Multifaceted Mathematics Capability Center on Mathematics at the Interfaces of Data, Models, and Decisions (Department of Energy, \$16.7M total budget over 5 years). Lead PI, Dynamic Data Driven Methods for Self-aware Aerospace Vehicles (Air Force Office of Scientific Research, \$2.5M total budget over 6 years). Lead PI, Towards Scalable Differentiated Instruction using Technology-Enabled Competency-Based Dynamic Scaffolding (Department of Education, \$2.9M total budget over 4 years).

Administrative: Director of the Oden Institute for Computational Engineering and Sciences at UT Austin (2018-present). Oversees Oden Institute operations involving >350 people, >\$70M in active research contracts/grants, and >\$150M endowment funding. Served as the founding co-director of the MIT Center for Computational Engineering (2008-2018) and the Associate Head of the MIT Department of Aeronautics and Astronautics (2011-2013). In Associate Head role, led reforms in the undergraduate degree program and put in place initiatives that successfully increased undergraduate enrollment in aerospace engineering.

Professional: Active professional service and leadership through multiple conference organizing committees, conference chair positions, technical committee leadership, organizational review committees, advisory boards, and editorial positions.

Outreach: Active in outreach activities to promote girls' interest in science, mathematics and engineering, including volunteer grade school science extension classes, many outreach visits to schools, and participation in the Advisory Board for Girls' Angle.

Publications: Edited Volumes and Books

1. Benner, P., Cohen, A., Ohlberger, M. and Willcox, K., *Model Reduction and Approximation: Theory and Algorithms*, SIAM Computational Science and Engineering Book Series, SIAM, Philadelphia, PA, 2017.
2. Biegler, L., Biros, G., Ghattas, O., Heinkenschloss, M., Keyes, D., Mallick, B., Tenorio, L., van Bloemen Waanders, B., Willcox, K. and Marzouk, Y. *Large-scale Inverse Problems and Quantification of Uncertainty*, Wiley Series in Computational Statistics, John Wiley & Sons, 2011.

Publications: Refereed Journal Articles

1. Qian, E., Kramer, B., Peherstorfer, B., and Willcox, K., Lift & Learn: Physics-informed machine learning for large-scale nonlinear dynamical systems. *Physica D: Nonlinear Phenomena*, Volume 406, May 2020, 132401.
2. Swischuk, R., Kramer, B., Huang, C., and Willcox, K., Learning physics-based reduced-order models for a single-injector combustion process. *AIAA Journal*, published online March 2020. Also in Proceedings of 2020 AIAA SciTech Forum & Exhibition, Orlando FL, January, 2020. DOI 10.2514/1.J058943
3. Marques, A., Lam, R., Chaudhuri, A., Opgenoord, M. and Willcox, K., A multifidelity method for locating aeroelastic flutter boundaries. *AIAA Journal*, published online January 2020. Also in 21st AIAA Non-Deterministic Approaches Conference (AIAA Scitech), San Diego, CA, January 2019. DOI 10.2514/6.2019-0438.
4. Chaudhuri, A., Kramer, B., and Willcox, K., Information Reuse for Importance Sampling in Reliability-Based Design Optimization, *Reliability Engineering & System Safety*, to appear, 2020.
5. Cook, L., Willcox, K., and Jarrett, J., Design Optimization Using Multiple Dominance Relations, *International Journal for Numerical Methods in Engineering*, to appear, 2020.
6. Lam, R., Zahm, O., Marzouk, Y. and Willcox, K., Multifidelity Dimension Reduction via Active Subspaces, *SIAM Journal on Scientific Computing*, to appear, 2020.
7. Cook, L., Mishra, A., Jarrett, J. Willcox, K., and Iaccarino, G. Optimization under turbulence model uncertainty for aerospace design, *Physics of Fluids*, Vol. 31, Issue 10, 105111, 2019.
8. Feldstein, A., Lazzara, D., Princen, N. and Willcox, K., Multifidelity Data Fusion with Application to Blended-Wing-Body Multidisciplinary Analysis Under Uncertainty, *AIAA Journal*, published online 20 Oct 2019.

9. Opgenoord, M. and Willcox, K., Design Methodology for Aeroelastic Tailoring of Additively-Manufactured Lattice Structures using Low-Order Methods, *AIAA Journal*, published online 19 Sep 2019.
10. Kapteyn, M., Willcox, K. and Philpott, A., Distributionally Robust Optimization for Engineering Design under Uncertainty. *International Journal for Numerical Methods in Engineering*, Vol. 120, Issue 7, pp. 835-859, July 2019. (An earlier version of this work appeared in AIAA Paper 2018-0666 in Proceedings of 2018 AIAA Non-Deterministic Approaches Conference, AIAA SciTech Forum, Kissimmee, FL, January, 2018.)
11. Opgenoord, M. and Willcox, K., Design for Additive Manufacturing: Cellular Structures in Early-Stage Aerospace Design, *Structural and Multidisciplinary Optimization*, Vol. 60, Issue 2, pp 411-428, 2019.
12. Kramer, B., Marques, A., Peherstorfer, B., Villa, U. and Willcox, K., Multifidelity probability estimation via fusion of estimators, *Journal of Computational Physics*, Vol. 392, pp. 385-402, 2019.
13. Kramer, B. and Willcox, K., Nonlinear model order reduction via lifting transformations and proper orthogonal decomposition, *AIAA Journal*, Vol. 57, No. 6, pp. 2297-2307, 2019.
14. Opgenoord, M., Drela, M. and Willcox, K., Influence of Transonic Flutter on the Conceptual Design of Next-Generation Transport Aircraft, *AIAA Journal*, Vol. 57, No. 5, pp. 1973-1987, 2019.
15. Swischuk, R., Mainini, L., Peherstorfer, B. and Willcox, K., Projection-based model reduction: Formulations for physics-based machine learning, *Computers and Fluids*, Vol. 179, pp. 704-717, January 2019.
16. Heinkenschloss, M., Kramer, B., Takhtaganov, T. and Willcox, K., Conditional-Value-at-Risk Estimation via Reduced-Order Models, *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 6, Issue 4, pp. 1395-1423, 2018.
17. Cook, L., Jarrett, J. and Willcox, K., Generalized information reuse for optimization under uncertainty with non-sample average estimators, *International Journal for Numerical Methods in Engineering*, Volume 115, Issue 12, pp. 1457-1476, September 2018.
18. Qian, E., Peherstorfer, B., O'Malley, D., Vesselinov, V. and Willcox, K., Multifidelity Monte Carlo estimation of variance and sensitivity indices, *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 6, No. 2, pp. 683-706, 2018.
19. Singh, V. and Willcox, K., Engineering Design with Digital Thread. *AIAA Journal*, Vol. 56, No. 11, pp. 4515-4528, 2018. Also in proceedings of 2018 AIAA Scitech Forum, Kissimmee, FL, January, 2018.
20. Baptista, R., Marzouk, Y., Willcox, K. and Peherstorfer, B., Optimal Approximations of Coupling in Multidisciplinary Models. *AIAA Journal*, Vol. 56, No. 6, pp. 2412-2428, 2018. (An earlier version of this work appeared in AIAA paper 2017-1935, 58th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference (AIAA Scitech), Grapevine, TX, January 2017.)
21. Peherstorfer, B., Kramer, B. and Willcox, K., Multifidelity preconditioning of the cross-entropy method for rare event simulation and failure probability estimation. *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 6, No. 2, pp. 737-761, 2018.
22. Li, H., Garg, V. and Willcox, K. Model adaptivity for goal-oriented inference using adjoints, *Computer Methods in Applied Mechanics and Engineering*, Vol. 331, pp. 1-22, April 2018.
23. Rude, U., Willcox, K., McInnes, L.C., De Sterck, H., Biros, G., Bungartz, H., Coronas, J., Cramer, E., Crowley, J., Ghattas, O., Gunzburger, M., Hanke, M., Harrison, R., Heroux, M., Hesthaven, J., Jimack, P., Johnson, C., Jordan, K.E., Keyes, D.E., Krause, R., Kumar, V., Mayer, S., Meza, J., Mørken, K.M., Oden, J.T., Petzold, L., Raghavan, P., Shontz, S.M., Trefethen, A., Turner, P., Voevodin, V., Wohlmuth, B., and Woodward, C.S. Research and Education in Computational Science and Engineering, *SIAM Review*, Vol. 60, No. 3, 2018.
24. Curran, C., Allaire, D. and Willcox, K., Sensitivity Analysis Methods for Mitigating Uncertainty in Engineering System Design, *Systems Engineering*, published online January 2018. (Also AIAA Paper 2015-0899, 56th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Kissimee, FL, January 5-9 2015.)

25. Opgenoord, M., Drela, M. and Willcox, K., Towards a Low-Order Model for Transonic Flutter Prediction, *AIAA Journal*, Vol. 56, No. 4, pp. 1519-1531, 2018. (Also AIAA Paper 2017-4340, AIAA Theoretical Fluid Mechanics Conference Best Paper.)
26. Peherstorfer, B., Gunzburger, M. and Willcox, K., Convergence analysis of multifidelity Monte Carlo estimation, *Numerische Mathematik*, 139(3):683-707, 2018.
27. Zimmermann, R., Peherstorfer, B. and Willcox, K., Geometric Subspace Updates with Applications to Online Adaptive Nonlinear Model Reduction, *SIAM Journal on Matrix Analysis and Applications*, Vol. 39, No. 1, pp. 234-261, 2018.
28. Peherstorfer, B., Willcox, K. and Gunzburger, M., Survey of multifidelity methods in uncertainty propagation, inference, and optimization, *SIAM Review*, Vol. 60, No. 3, 2018.
29. Willcox K. and Huang, L., Network models for mapping educational data, *Design Science*, Vol. 3, e18, 2017.
30. Peherstorfer, B., Gugercin, S. and Willcox, K., Data-driven reduced model construction with time-domain Loewner models, *SIAM Journal on Scientific Computing*, Vol. 39, No. 5, pp. A2152-A2178, 2017.
31. Cook, L., Jarrett, J. and Willcox, K., Extending horsetail matching for optimization under probabilistic, interval and mixed uncertainties, *AIAA Journal*, Vol. 56, No. 2, pp. 849-861, 2018.
32. Chaudhuri, A., Lam, R. and Willcox, K., Multifidelity uncertainty propagation via adaptive surrogates in coupled multidisciplinary systems. *AIAA Journal*, Vol. 56, No. 1, pp. 235-249, 2018.
33. Nguyen V.B., Dou HS., Willcox K., Khoo BC., Model order reduction for reacting flows: laminar Gaussian flame applications. In: Ben-Dor G., Sadot O., Igra O. (eds) *30th International Symposium on Shock Waves*, Springer, 2017.
34. Peherstorfer, B., Kramer, B. and Willcox, K., Combining multiple surrogate models to accelerate failure probability estimation with expensive high-fidelity models, *Journal of Computational Physics*, Vol. 341, pp. 61-75, 2017.
35. Kramer, B., Peherstorfer, B. and Willcox, K., Feedback Control for Systems with Uncertain Parameters Using Online-Adaptive Reduced Models, *SIAM Journal on Applied Dynamical Systems*, Vol. 16, No. 3, pp. 1563-1586, 2017.
36. Qian, E., Grepl, M., Veroy, K., and Willcox, K., A certified trust region reduced basis approach to PDE-constrained optimization, *SIAM Journal on Scientific Computing*, Vol. 39, No. 5 pp. S434-S460, 2017.
37. Singh, V. and Willcox, K., Methodology for Path Planning with Dynamic Data-Driven Flight Capability Estimation, *AIAA Journal*, Vol. 55, No. 8, pp. 2727-2738, 2017.
38. Spantini, A., Cui, T., Willcox, K., Tenorio, L. and Marzouk, Y. Goal-oriented optimal approximations of Bayesian linear inverse problems, *SIAM Journal on Scientific Computing*, Vol. 39, No. 5 pp. S167-S196, 2017.
39. Mainini, L. and Willcox, K., Data to decisions: Real-time structural assessment from sparse measurements affected by uncertainty, *Computers and Structures*, Vol. 182, pp. 296-312, 2017.
40. Peherstorfer, B., Willcox, K. and Gunzburger, M., Optimal model management for multifidelity Monte Carlo estimation, *SIAM Journal on Scientific Computing*, Vol. 38, No. 5, pp. A3163-A3194, 2016.
41. Amaral, S., Allaire, D., Willcox, K. and de la Rosa Blanco, E., A Decomposition-Based Uncertainty Quantification Approach for Environmental Impacts of Aviation Technology and Operation, *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, Volume 31, Issue 3 (Uncertainty Quantification for Engineering Design), pp. 251-264, August 2017.
42. Ulker, F., Allaire, D. and Willcox, K., Sensitivity Guided Decision Making for Wind Farm Micro-Siting, *International Journal for Numerical Methods in Fluids*, Vol. 83, Iss. 1, pp. 52-72, 2017.
43. Garg, V., Tenorio, L. and Willcox, K. Minimum local distance density estimation, *Communications in Statistics – Theory and Methods*, Vol. 46, No. 1, pp. 148-164, 2017.
44. Amaral, S., Allaire, D. and Willcox, K. Optimal L2-norm Empirical Importance Weights for the Change of Probability Measure, *Statistics and Computing*, 27 (3), 625-643, May 2017.

45. Opgenoord, M., Allaire, D. and Willcox, K., Variance-Based Sensitivity Analysis to Support Simulation-based Design under Uncertainty, *Journal of Mechanical Design*, Vol. 138, No. 11, pp. 111410-111410-12, 2016.
46. Zimmermann, R. and Willcox, K., An Accelerated Greedy Missing Point Estimation Procedure, *SIAM Journal on Scientific Computing*, Vol. 38, Issue 5, pp. A2827–A285, 2016.
47. Peherstorfer, B. and Willcox, K., Data-driven operator inference for nonintrusive projection-based model reduction, *Computer Methods in Applied Mechanics and Engineering*, Vol. 306, pp. 196-215, 2016.
48. Cui, T., Marzouk, Y. and Willcox, K., Scalable posterior approximations for large-scale Bayesian inverse problems via likelihood-informed parameter and state reduction, *Journal of Computational Physics*, available online 29 March 2016.
49. Peherstorfer, B. and Willcox, K., Dynamic data-driven model reduction: Adapting reduced models from incomplete data, *Advanced Modeling and Simulation in Engineering Sciences*, Vol. 3, Issue 1, 2016.
50. Opgenoord, M. and Willcox, K., Sensitivity Analysis Methods for Uncertainty Budgeting in System Design, *AIAA Journal*, Volume 54, Issue 10, pp. 3134-3148, 2016.
51. Peherstorfer, B., Cui, T., Marzouk, Y. and Willcox, K., Multifidelity importance sampling, *Computer Methods in Applied Mechanics and Engineering*, Vol. 300, pp. 490-509, 2016.
52. Benner, P., Gugercin, S. and Willcox, K., A Survey of Projection-Based Model Reduction Methods for Parametric Dynamical Systems, *SIAM Review*, Vol. 57, No. 4, pp. 483–531, 2015.
53. Peherstorfer, B. and Willcox, K., Online Adaptive Model Reduction for Nonlinear Systems via Low-Rank Updates, *SIAM Journal on Scientific Computing*, Vol. 37, No. 4, pp. A2123-A2150, 2015.
54. Peherstorfer, B. and Willcox, K., Dynamic data-driven reduced-order models, *Computer Methods in Applied Mechanics and Engineering*, Vol. 291, pp. 21-41, 2015.
55. Lecerf, M., Allaire, D. and Willcox, K. Methodology for Dynamic Data-Driven Online Flight Capability Estimation, *AIAA Journal*, Vol. 53, No. 10, pp. 3073-3087, October 2015. (An earlier version of this work appeared in AIAA Paper 2014-1175, January 2014.)
56. Peherstorfer, B. and Willcox, K., Detecting and Adapting to Parameter Changes for Reduced Models of Dynamic Data-driven Application Systems, *Procedia Computer Science*, Vol. 51, pp. 2553-2562, 2015.
57. Ng, L. and Willcox, K. Monte Carlo Information-Reuse Approach to Aircraft Conceptual Design Optimization Under Uncertainty, *Journal of Aircraft*, Vol. 53, No. 2, pp. 427-438, 2016. (An earlier version of this work appeared in AIAA Paper 2014-0802, January 2014.)
58. Mainini, L. and Willcox, K. A surrogate modeling approach to support real-time structural assessment and decision-making, *AIAA Journal*, Vol. 53, No. 6, pp. 1612-1626, 2015. (An earlier version of this work appeared in AIAA Paper 2014-1488, presented at 10th AIAA Multidisciplinary Design Optimization Conference, National Harbor, MD, January 2014.)
59. Liao, Q. and Willcox, K. A domain decomposition approach for uncertainty analysis, *SIAM Journal on Scientific Computing*, Vol. 37, No. 1, pp. A103-A133, 2015.
60. Amaral, S., Allaire, D. and Willcox, K. A decomposition-based approach to uncertainty analysis of feed-forward multicomponent systems, *International Journal for Numerical Methods in Engineering*, Volume 100, Issue 13, pages 982-1005, December 2014.
61. Ng, L. and Willcox, K. Multifidelity Approaches for Optimization Under Uncertainty, *International Journal for Numerical Methods in Engineering*, Volume 100 Issue 10, pp. 746-772, published online 17 September, 2014, DOI: 10.1002/nme.4761. (An earlier version of this work appeared in AIAA Paper 2012-5602, September 2012.)
62. Cui, T., Marzouk, Y. and Willcox, K. Data-driven model reduction for the Bayesian solution of inverse problems, *International Journal for Numerical Methods in Engineering*, Vol. 102, No. 5, pp. 966-990, published online 15 August, 2014, DOI: 10.1002/nme.4748.

63. Allaire, D. and Willcox, K. Uncertainty assessment of complex models with application to aviation environmental policy-making, *Transport Policy*, Volume 34, July 2014, pp. 109-113. Available online 20 March 2014, ISSN 0967-070X, <http://dx.doi.org/10.1016/j.tranpol.2014.02.022>.
64. Allaire, D., Kordonowy, D., Lecerf, M., Mainini, L. and Willcox, K. Multifidelity DDDAS Methods with Application to a Self-Aware Aerospace Vehicle, *Procedia Computer Science*, Vol. 29, pp. 1182-1192, 2014.
65. Allaire, D., Noel, G., Willcox, K. and Cointin, R. Uncertainty quantification of an aviation environmental toolsuite, *Reliability Engineering and System Safety*, Volume 126, June 2014, pp. 14-24. Available online 15 January 2014.
66. Nguyen, V.B., Buffoni, M., Willcox, K. and Khoo, B.C. Model reduction for reacting flow applications, *International Journal of Computational Fluid Dynamics*, Volume 28, Issue 3-4, May 2014.
67. Nguyen, N.C., Khoo, B.C. and Willcox, K. Model order reduction for Bayesian approach to inverse problems, *Asia Pacific Journal on Computational Engineering*, Vol. 1, No. 2, April 2014.
68. Lieberman, C. and Willcox, K. Nonlinear Goal-Oriented Bayesian Inference: Application to Carbon Capture and Storage, *SIAM Journal on Scientific Computing*, Vol. 36, No. 3, pp. B427-B449.
69. Peherstorfer, B., Butnaru, D., Willcox, K. and Bungartz, H.-J., Localized discrete empirical interpolation method, *SIAM Journal on Scientific Computing*, Vol. 36, No. 1, pp. A168-A192, 2014.
70. Allaire, D. and Willcox, K. A mathematical and computational framework for multifidelity design and analysis with computer models, *International Journal on Uncertainty Quantification*, Vol. 4, Issue 1, pp. 1-20, January 2014.
71. Burgiel, H., Lieberman, C., Miller, H. and Willcox, K. Interactive applets in calculus and engineering courses, chapter in *Enhancing Mathematics Understanding through Visualization: The Role of Dynamical Software*, S. Habre (Ed.), IGI Global, December 2013.
72. Kaijima, S., Bouffanais, R., Willcox, K. and Naidu, S. Computational fluid dynamics for architectural design, in *Computation Works: The Building of Algorithmic Thought*, Architectural Design, X. De Kestelier, B. Peters (eds), March 2013.
73. Lieberman, C. and Willcox, K. Goal-oriented inference: Approach, linear theory, and application to advection-diffusion, *SIAM Review*, Vol. 55, No. 3, pp. 493-519, 2013. (SIGEST award)
74. Lieberman, C., Fidkowski, K., Willcox, K. and van Bloemen Waanders, B. Hessian-based model reduction: Large-scale inversion and prediction, *International Journal of Numerical Methods in Fluids*, Vol. 71, pp. 135-150, January 2013.
75. Lieberman, C. and Willcox, K. Goal-oriented inference: Approach, linear theory, and application to advection-diffusion, *SIAM Journal on Scientific Computing*, Vol. 34, No.4, pp. 1880-1904, 2012.
76. Allaire, D, He, Q., Deyst, J. and Willcox, K. An Information-theoretic Metric of System Complexity with Application to Engineering System Design, *Journal of Mechanical Design*, Vol. 134, Issue 10, October, 2012.
77. March, A. and Willcox, K. A Provably Convergent Multifidelity Optimization Algorithm not Requiring High-Fidelity Derivatives, *AIAA Journal*, Vol. 50, No. 5, pp. 1079-1089, 2012.
78. March, A. and Willcox, K. Constrained multifidelity optimization using model calibration, *Structural and Multidisciplinary Optimization*, Vol. 46, pp. 93-109, 2012.
79. March, A., Wang, Q. and Willcox, K. Gradient-based Multifidelity Optimization for Aircraft Design using Bayesian Model Calibration, *The Aeronautical Journal*, Vol. 115, No. 1174, December, 2011.
80. Allaire, D. and Willcox, K. A Variance-Based Sensitivity Index Function for Factor Prioritization, *Reliability Engineering and System Safety*, Vol. 107, November 2012, pp. 107-114.
81. Allaire, D. and Willcox, K. Distributional Sensitivity Analysis, *Procedia – Social and Behavioral Sciences*, Vol. 2, Issue 6, pp. 7595-7596, 2010.

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3. Qian, E., Kramer, B., Marques, A. and Willcox, K., Transform & Learn: A data-driven approach to nonlinear model reduction. In Proceedings of AIAA Aviation Forum & Exhibition, Dallas, TX, June 2019.
4. Chaudhuri, A., Marques, A., Lam, R., and Willcox, K., Reusing information for multifidelity active learning in reliability-based design optimization. 21st AIAA Non-Deterministic Approaches Conference (AIAA Scitech), San Diego, CA, January 2019.

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6. Peherstorfer, B., Beran, P.S., and Willcox, K., Multifidelity Monte Carlo Estimation for Large-scale Uncertainty Propagation. In proceedings of 2018 AIAA Scitech Forum, Kissimmee, FL, January, 2018.
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1. National Academies of Sciences, Engineering, and Medicine. Data-Driven Modeling for Additive Manufacturing of Metals: Proceedings of a Workshop. The National Academies Press, Washington D.C., 2019.
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1. Marzouk, Y. and Willcox, K., Uncertainty Quantification, in The Princeton Companion to Applied Mathematics, N.J. Higham (ed.), Princeton University Press, 2015.
2. Miller, H., Willcox, K. and Huang, L., Crosslinks: Improving Course Connectivity Using Online Open Educational Resources, in The Bridge, The National Academy of Sciences, Volume 46, Number 3, pp. 38-44, Fall 2016.

PhD Students Supervised

1. Patricia Astrid, TU Eindhoven PhD 2004. Now at Shell Global Solutions.
2. Tan Bui-Thanh, MIT PhD 2007. Now Associate Professor of Aerospace Engineering and Engineering Mechanics, UT Austin.
3. Theresa Robinson. MIT PhD 2007. Now at Rolls Royce.
4. Leia Stirling, MIT PhD 2008. Now Associate Professor of Industrial and Operations Engineering, University of Michigan.
5. Svein Hovland, Norwegian University of Science and Technology PhD 2008. Now at Frontier International.
6. Doug Allaire, MIT PhD 2009. Now Assistant Professor of Mechanical Engineering, Texas A&M University.
7. Van Bo Nguyen, National University of Singapore PhD 2011. Now at A*STAR Institute for High Performance Computing.
8. David Lazzara, MIT PhD 2012. Now at The Boeing Company.
9. Andrew March, MIT PhD 2012. Now at MIT Lincoln Laboratory.
10. Ngoc Hien Nguyen, National University of Singapore PhD 2012. Now at National University of Singapore.
11. Chad Lieberman, MIT PhD 2013. Now at Chad E Lieberman Consulting.
12. Leo Ng, MIT PhD 2013. Now at Mathworks.
13. Chelsea Curran (He), MIT PhD 2014. Now at MIT Lincoln Laboratory.
14. Sergio Amaral, MIT PhD 2015. Now at Millenium Management.
15. Brian Cohen, MIT PhD 2018. Now at MIT Lincoln Laboratory.
16. Remi Lam, MIT PhD 2018. Now at DeepMind.
17. Max Opgenoord, MIT PhD 2018. Now at Amazon Prime Air.
18. Harriet Li, MIT PhD 2019. Now at Johns Hopkins University Applied Physics Laboratory.
19. Victor Singh, MIT PhD 2019. Now at The Boeing Company.

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Postdoctoral Researchers Supervised

1. Doug Allaire (MIT). Now Assistant Professor, Texas A&M University.
2. Marcelo Buffoni (MIT). Now at ABB Switzerland Ltd.
3. Laurence Cook (MIT). Now at Arrival.
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5. Sonjoy Das (MIT). Now Assistant Professor, University at Buffalo.
6. Krzysztof Fidkowski (MIT). Now Associate Professor, University of Michigan.
7. Michalis Frangos (MIT). Now Research Scientist, Schlumberger Cambridge Research.
8. Vikram Garg (MIT). Now at Esgee Technologies.
9. Phuong Huynh (MIT). Now Head of Operation and Research, Akselos.
10. Boris Kramer (MIT). Now Assistant Professor, University of California, San Diego.
11. Remi Lam (MIT). Now at DeepMind.
12. Qifeng Liao (MIT). Now Assistant Professor, ShanghaiTech University.
13. Chad Lieberman (MIT). Now at Chad E Lieberman Consulting.
14. Laura Mainini (MIT). Now Research Scientist, United Technologies Research Corporation.
15. Alexandre Marques (MIT). Now at NanoSemi.
16. Benjamin Peherstorfer (MIT). Now Assistant Professor, Courant Institute, New York University.
17. Demet Ulker (MIT). Now at Envision Energy.
18. Ralf Zimmermann (MIT). Now Associate Professor, University of Southern Denmark.