

Karen E. Willcox, MNZM, PhD
Director, Oden Institute for Computational Engineering and Sciences
Associate Vice President for Research
Professor of Aerospace Engineering and Engineering Mechanics
W. A. "Tex" Moncrief, Jr. Chair in Simulation-Based Engineering and Sciences
Peter O'Donnell, Jr. Centennial Chair in Computing Systems
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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

2020-present Associate Vice President for Research
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

2012-2018 Professor, Aeronautics and Astronautics
2011-2013 Associate Department Head, Aeronautics and Astronautics
2008-2018 Founding Co-Director, MIT Center for Computational Engineering
2005-2012 Associate Professor, Aeronautics and Astronautics
2001-2005 Assistant Professor, Aeronautics and Astronautics

Singapore University of Technology and Design

2018 Visiting Professor (7-month stay)
2015 Visiting Professor (6-month stay)
2011 Visiting Associate Professor (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

Karen E. Willcox, MNZM, PhD

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 and scientific machine learning. 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).

Diversity, Equity and Inclusion: Architected and implemented new Diversity, Equity, Inclusion and Outreach plan at the Oden Institute. Grew diversity of undergraduate and graduate aerospace engineering student body as Associate Department Head in MIT. Led Rising Stars events at MIT and UT Austin to foster gender diversity in aerospace engineering and computational sciences. Active in outreach activities to promote girls' interest in science, mathematics and engineering, including volunteer grade school science extension classes, many outreach visits to K-12 schools, and participation in the Advisory Board for Girls' Angle. First-generation student mentor at MIT.

Professional Memberships

Member, National Academy of Engineering (NAE)

Fellow, American Institute of Aeronautics and Astronautics (AIAA)

Fellow, Society for Industrial and Applied Mathematics (SIAM)

Fellow, U.S. Association for Computational Mechanics

Member, American Society for Engineering Education (ASEE)

Member, American Mathematical Society (AMS)

Member, Design Society

External Boards and Committees (active)

American Institute of Physics (AIP) Publishing, Board of Managers (2023 – present)

CIMNE – International Centre for Numerical Methods in Engineering, Spain, Scientific Advisory Council (2023 – 2027)

Oak Ridge National Laboratory, Advisory Committee, Computing and Computational Sciences Directorate (2023 – present)

Department of the Air Force Scientific Advisory Board (2023 – present)

National Academies Study on Foundational Research Gaps and Future Directions for Digital Twins (Chair, 2022 – 2023)

Harvard University, Committee to Visit Harvard University Information Technology (HUIT) (2019 – present; Chair, 2022 – present)

International Association for Computational Mechanics (IACM), Executive Council (2022 – 2028)

Claremont McKenna College, Founding Science Advisory Council (2021 – present)

Institute for Water Futures, Australian National University, Advisory Board (2021 – 2024)

Advanced Simulation and Computing (ASC) at the Los Alamos National Laboratory, Advisory Board (2021 – present)

MATH+ Scientific Advisory Board, Germany (2021 – present)

AIAA Board of Trustees (2020 – 2026)

Institute for Mathematical and Statistical Innovation (IMSI) Board of Trustees (2020 – 2024)

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

Karen E. Willcox, MNZM, PhD

Santa Fe Institute, Science Board (2019 – present)

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

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

National Academies Board on Mathematical Sciences and Analytics (BMSA) (Co-chair, 2023 – present; member 2016 – present)

Girls' Angle, Advisory Board (2014 – present)

External Boards and Committees (past)

Oak Ridge National Laboratory, Search Committee, Associate Laboratory Director for the Computing and Computational Sciences Directorate (2023)

National Academies Study on Post-Exascale Computing for the National Nuclear Security Administration (2021 – 2023)

AIAA 2023 SciTech Forum Guiding Coalition

National Science Foundation, Advisory Committee for Cyberinfrastructure (2019 – 2022, Co-chair 2020 – 2022)

SIAM 2022 Conference on Mathematics of Data Science, Co-Chair (MDS22)

AIAA 2022 SciTech Forum, Executive Steering Committee

SIAM Activity Group on Data Science (Inaugural Program Director, 2021 – 2022)

AIAA Multidisciplinary Design Optimization (MDO) Technical Committee (2001 – 2021); Chair (2019 – 2021);

Vice-Chair (2017 – 2019); Awards Subcommittee Chair (2003 – 2006); Publications Subcommittee Chair (2011 – 2018)

SIAM Journals Committee (2019 – 2021)

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

AIAA Fellows Selection Committee (2019 – 2022)

SIAM Fellows Selection Committee (2018 – 2020)

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

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

SIAM Committee on Science Policy (2016 – 2018)

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

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

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

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

Department of Engineering Science, University of Auckland, Advisory Board (Member, 2008 – 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 MDO Conference Technical Chair (2011 – 2012)

Visiting Committees and Review Boards (past)

ExxonMobil Corporate Strategic Research, Capability Assessment External Review Panel (Physics and Mathematical Science and Scientific Computing) (2021)

Delft University of Technology, Netherlands, Review Committee, Research Assessment of Aerospace Engineering (2020 – 2022)

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

TU Braunschweig Universities of Excellence, German Excellence Initiative, Review Committee (2018)

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

HarvardX Review Committee, Harvard University (Member, 2016)

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

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

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

Editorial Boards

Computer Methods in Applied Mechanics and Engineering (Editorial Board Member, 2022 – present)

International Journal of Computational Methods in Engineering Science and Mechanics (Advisory Board Member, 2022 – present)

Acta Numerica (Editorial Board Member, 2021 – present)

IEEE Computing in Science and Engineering (CiSE) (Associate Editor, 2021 – present)

AIAA Journal (Editorial Board Member, 2021 – present; Associate Editor, 2015 – 2020 and 2009 – 2011)

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

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

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

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

Major Internal Committees and Leadership Roles (at MIT and UT Austin)

UT Austin Provost Search Advisory Committee, Chair (2021)

Associate Vice President for Research, UT Austin (2020 – present)

Director, Oden Institute for Computational Engineering and Sciences, UT Austin (2018 – present)

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

MIT Online Education Policy Initiative, Co-Chair (2015 – 2016)

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

Co-Chair, Mission and Scope Subcommittee, Ad Hoc Committee on the Formation of a New Entity in the Areas of Complex and Socio-technical Systems, Information and Decision Systems, and Statistics (2013 – 2014)

Associate Department Head, MIT Department of Aeronautics and Astronautics (2011 – 2013)

Chair, Ad Hoc Committee on Statistics at MIT (2011 – 2012)

Founding Co-Director, MIT Center for Computational Engineering (2008 – 2018)

Public Positions and Testimonies

Testified to Congress for the Subcommittee on Energy of the House Committee on Science, Space, and Technology hearing on Accelerating Discovery: the Future of Scientific Computing at the Department of Energy (May 2021).

Selected Awards and Honors

2023 U.S. Association for Computational Mechanics J. Tinsley Oden Medal “for contributions to model reduction and multi-fidelity methods for the design and optimal control of high-dimensional systems with uncertainties.”

Karen E. Willcox, MNZM, PhD

USACM Fellow, Class of 2023. “For outstanding achievements in developing scalable methods for design of predictive digital twins under uncertainty, reduced-order modeling, data-to-decisions in aerospace engineering, and her leadership roles in computational sciences and engineering.”

2022 Lecturer for the Leçons Jacques-Louis Lions, Sorbonne University.

Paper “Design of digital twin sensing strategies via predictive modeling and interpretable machine learning” selected as a Featured Article for *Journal of Mechanical Design*, August 2022.

Paper “A probabilistic graphical model foundation for enabling predictive digital twins at scale” selected for the *Nature Computational Science* one-year anniversary collection.

Elected to the National Academy of Engineering “for contributions to computational engineering methods for the design and optimal control of high-dimensional systems with uncertainties” 2022.

AIAA Structures, Structural Dynamics, and Materials (SDM) Lecture, presented at AIAA Scitech Forum, January 2022.

Best Paper Award for “Toward predictive digital twins via component-based reduced-order models and interpretable machine learning”, AIAA Multidisciplinary Design Optimization Best Paper, 2020

SIAM Student Paper Prize (E. Qian), “Multifidelity Monte Carlo estimation of variance and sensitivity indices,” 2020

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

Paper “Variance-based sensitivity analysis to support simulation-based design under uncertainty” one of the top 10 most accessed articles in *Journal of Mechanical Design* in 2019.

AIAA Fellow, Class of 2019. “For outstanding contributions to the development and use of computational methods for aerospace design, and to engineering education and outreach.”

SIAM Fellow, Class of 2018. “For contributions to model reduction and multifidelity methods, with applications in optimization, control, design, and uncertainty quantification of large-scale systems.”

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 (MNZM), awarded for services to aerospace engineering and education, 2017

Distinguished Alumni Award, University of Auckland, 2016

Member, Harvard Higher Education Leaders Forum, 2016 – 2019

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 hundreds of invited lectures in the US and internationally, including multiple plenary/keynote talks at major international conferences in engineering, mathematics, and computational sciences. Published over 130 papers in refereed archival journals. Supervised 64 graduate theses (41 M.S., 23 PhD). Multiple graduate students and postdocs hold academic positions at prestigious universities and leadership positions in industry. Secured funding and managed multi-institutional research projects from many sources including the U.S. Air Force, Boeing, Lockheed Martin, 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, M2dt Multifaceted Mathematics Capability Center on Multifaceted Mathematics for Predictive Digital Twins (Department of Energy, \$13.5M total budget over 5 years). 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 (MURI) project on Managing Multiple Information Sources of Multi-physics Systems (Air Force Office of Scientific Research, \$7.2M total budget over 5 years). Lead PI, MURI project on Machine Learning for Physics-Based Systems (Air Force Office of Scientific Research, \$2M total budget over 3 years). Lead PI, RISE of the Machines: Robust, Interpretable, Scalable, Efficient Decision Support (Department of Energy, \$4.4M total budget over 3 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) and Associate Vice President for Research (2020-present). Oversees Oden Institute operations involving >450 people, 25 research groups and centers, >\$130M in active research contracts/grants, and >\$150M endowment funding. Strategic leadership for Oden Institute research priorities, educational programs, administrative functions, external partnerships, financial management, and development. Previously, 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. Professional advocacy through leadership positions in SIAM and AIAA, and membership in key National Academies, Department of Energy, and National Science Foundation committees. Testified to Congress on scientific computing (2021).

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. Croci, S., Wright, S. and Willcox, K. Multi-output multilevel best linear unbiased estimators via semidefinite programming. *Computer Methods in Applied Mechanics and Engineering*, Vol. 413, August 2023, 1167130.
2. McQuarrie, S., Khodabakhshi, P. and Willcox, K. Non-intrusive reduced-order models for parametric partial differential equations via data-driven operator inference. *SIAM Journal on Scientific Computing*. Vol. 45, No. 4, 2023, pp. A1917-A1946.
3. Geelen, R., Wright, S. and Willcox, K. Operator inference for non-intrusive model reduction with quadratic manifolds. *Computer Methods in Applied Mechanics and Engineering*, Vol. 403, Part B, January 2023, 115717.
4. O'Leary-Roseberry, T., Du X., Chaudhuri, A., Martins, J., Willcox, K. and Ghattas, O. Learning high-dimensional parametric maps via reduced basis adaptive residual networks. *Computer Methods in Applied Mechanics and Engineering*, Vol. 402, December 2022, 115730.
5. Karandikar, J., Chaudhuri, A., Smith, S., Schmitz, T. and Willcox, K. Process window estimation in manufacturing through Entropy-Sigma active learning. *Manufacturing Letters*, Vol. 34, pp. 87-92, 2022.
6. McBane, S., Choi, Y. and Willcox, K. Stress-constrained topology optimization of lattice-like structures using component-wise reduced order models. *Computer Methods in Applied Mechanics and Engineering*, Vol. 400, October 2022, 115525.
7. Guo, M., McQuarrie, S. and Willcox, K. Bayesian operator inference for data-driven reduced-order modeling. *Computer Methods in Applied Mechanics and Engineering*, Volume 402, December 2022, 115336.
8. Kapteyn, M. and Willcox, K., Design of digital twin sensing strategies via predictive modeling and interpretable machine learning. *Journal of Mechanical Design*, June 2022. <https://doi.org/10.1115/1.4054907> (Selected as a Featured Article for *Journal of Mechanical Design*, August 2022.)
9. Cohen, B., March, A., Willcox, K. and Miller, D., A level set-based topology optimization approach for thermally radiating structures. *Structural and Multidisciplinary Optimization*, Vol. 65, No. 167, 2022.
10. Qian, E., Farcas, I., and Willcox, K., Reduced operator inference for nonlinear partial differential equations. *SIAM Journal on Scientific Computing*, Vol. 44, Issue 4, pp. A1934-A1959, 2022. <https://doi.org/10.1137/21M1393972>
11. Buchsbaum, Jeffrey C., et al. "Predictive Radiation Oncology—A New NCI–DOE Scientific Space and Community." *Radiation Research*, Vol. 197, No. 4, pp. 434-445, 2022.
12. Geelen, R. and Willcox, K., Localized non-intrusive reduced-order modeling in the operator inference framework. *Philosophical Transactions of the Royal Society A*, Vol. 380, Issue 2229, 20210206, 2022. <https://doi.org/10.1098/rsta.2021.0206>
13. Khodabakhshi, P. and Willcox, K. Non-intrusive data-driven model reduction for differential algebraic equations derived from lifting transformations. *Computer Methods in Applied Mechanics and Engineering*. Volume 389, 1 February 2022, 114296.
14. Ghattas, O. and Willcox, K., Learning physics-based models from data: Perspectives from inverse problems and model reduction. *Acta Numerica*, Vol. 30, pp. 445-554, 2021.
15. Chaudhuri, A., Kramer, B., Norton, M., Royset, J., and Willcox, K., Certifiable Risk-Based Engineering Design Optimization. *AIAA Journal*, Vol. 60, No. 2, pp. 551-565, February 2022.
16. Kapteyn, M., Pretorius, J. and Willcox, K., A probabilistic graphical model foundation for enabling predictive digital twins at scale. *Nature Computational Science*, Vol. 1, No. 5, May 2021, pp. 337-347. (Selected for the *Nature Computational Science* one-year anniversary collection.)
17. Niederer, S., Sacks, M., Girolami, M. and Willcox, K., Scaling digital twins from the artisanal to the industrial. *Nature Computational Science*, Vol. 1, No. 5, May 2021, pp. 313-320.
18. Khodabakhshi, P., Willcox, K., and Gunzburger, M. A multifidelity method for a nonlocal diffusion model. *Applied Mathematics Letters*, Volume 121, November 2021, 107361.
19. Willcox, K., Ghattas, O., and Heimbach, P. The imperative of physics-based modeling and inverse theory in computational science, *Nature Computational Science*, Vol. 1, No. 3, pp. 166-168, 2021.

20. Huang, L. and Willcox, K., Network models and sensor layers to design adaptive learning using educational mapping. *Design Science*, 7, E9. doi:10.1017/dsj.2021.8, 2021.
21. Ehre, M., Papaioannou, I., Willcox, K., and Straub, D., Conditional reliability analysis in high dimensions based on controlled mixture importance sampling and information reuse. *Computer Methods in Applied Mechanics and Engineering*, Volume 381, August 2021, 113826.
22. Singh, V. and Willcox, K., Decision Making Under Uncertainty for a Digital Thread Enabled Design Process. *Journal of Mechanical Design*, 143(9): 091707, September 2021.
23. McQuarrie, S., Huang, C. and Willcox, K., Data-driven reduced-order models via regularized operator inference for a single-injector combustion process. *Journal of the Royal Society of New Zealand*, Vol. 51, No. 2 pp. 194-211, 2021, DOI: 10.1080/03036758.2020.1863237.
24. Salinger S., Kapteyn M., Kays C., Pretorius J., Willcox K., A Hardware Testbed for Dynamic Data-Driven Aerospace Digital Twins. In: Darema F., Blasch E., Ravela S., Aved A. (eds) Dynamic Data Driven Application Systems. DDDAS 2020. *Lecture Notes in Computer Science*, Vol. 12312. Springer, Cham, 2020.
25. Chaudhuri, A., Marques, A., and Willcox, K., mfEGRA: Multifidelity Efficient Global Reliability Analysis through Active Learning for Failure Boundary Location. *Structural and Multidisciplinary Optimization*, Vol. 64, pp. 797–811, 2021.
26. Benner, P., Goyal, P., Kramer, B., Peherstorfer, B., and Willcox, K., Operator inference for non-intrusive model reduction of systems with non-polynomial nonlinear terms. *Computer Methods in Applied Mechanics and Engineering*, Vol. 372, pp. 113433, December 2020.
27. Kramer, B., and Willcox, K., Balanced Truncation Model Reduction for Lifted Nonlinear Systems. In Beattie, C., Benner, P., Embree, M., Gugercin, S., Lefteriu, S. (eds) *Realization and Model Reduction of Dynamical Systems*, Springer, Cham., 2021. https://doi.org/10.1007/978-3-030-95157-3_9
28. Kapteyn, M., Knezevic, D., Huynh, D.B.P., Tran, Minh and Willcox, K., Data-driven physics-based digital twins via a library of component-based reduced-order models. *International Journal for Numerical Methods in Engineering*, 2020, <https://doi.org/10.1002/nme.6423>.
29. 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*, Vol. 406, May 2020, 132401.
30. 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
31. Marques, A., Lam, R., Chaudhuri, A., Opgenoord, M. and Willcox, K., Multifidelity method for locating aeroelastic flutter boundaries. *AIAA Journal*, Vol. 58, No. 4, April 2020, pp. 1772-1784. Also in 21st AIAA Non-Deterministic Approaches Conference (AIAA Scitech), San Diego, CA, January 2019. DOI 10.2514/6.2019-0438.
32. Chaudhuri, A., Kramer, B., and Willcox, K., Information Reuse for Importance Sampling in Reliability-Based Design Optimization, *Reliability Engineering & System Safety*, Vol. 201, pp. 106853, 2020.
33. Cook, L., Willcox, K., and Jarrett, J., Design Optimization Using Multiple Dominance Relations, *International Journal for Numerical Methods in Engineering*, Vol. 121, Issue 11, pp. 2481-2502, June 2020.
34. Lam, R., Zahm, O., Marzouk, Y. and Willcox, K., Multifidelity Dimension Reduction via Active Subspaces, *SIAM Journal on Scientific Computing*, 42 (2), A929-A956, 2020.
35. Feldstein, A., Lazzara, D., Princen, N. and Willcox, K., Multifidelity Data Fusion with Application to Blended-Wing-Body Multidisciplinary Analysis Under Uncertainty, *AIAA Journal*, Vol. 58, No. 2, pp. 889-906, 2020.
36. 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.

37. Opgenoord, M. and Willcox, K., Design Methodology for Aeroelastic Tailoring of Additively-Manufactured Lattice Structures using Low-Order Methods, *AIAA Journal*, Vol. 57, No. 11, pp. 4903-4914, 2019.
38. 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.)
39. 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.
40. 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.
41. 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.
42. 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.
43. 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.
44. 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.
45. 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.
46. 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. (SIAM Student Paper Prize)
47. 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.
48. 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.)
49. 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.
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9. Andrew March, MIT PhD 2012. Now at MIT Lincoln Laboratory.
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