Matthew J. Zahr

Assistant Professor
Department of Aerospace and Mechanical Engineering
Center for Informatics and Computational Science
University of Notre Dame

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Research Interests

model reduction · finite element and discontinuous Galerkin methods · high-order discretizations · numerical methods for shocks and discontinuities · topology optimization · PDE-constrained optimization · multiphysics and multiscale problems · uncertainty quantification

Academic Positions

2019–pres **Assistant Professor**, Department of Aerospace and Mechanical Engineering, University of Notre Dame

2016–2018 **Luis W. Alvarez Postdoctoral Fellow**, Department of Mathematics, Lawrence Berkeley National Laboratory

2016–2018 **Postdoctoral Scholar**, Department of Mathematics, University of California, Berkeley

2015–2016 **Research Assistant**, Department of Aeronautics and Astronautics, Stanford University

Education

Sep 2016 **Ph.D., Computational and Mathematical Engineering, Stanford University** *Stanford, CA*
Advisor: Charbel Farhat
Ph.D. Minors: Mechanical Engineering, Aeronautics and Astronautics
Funding: Department of Energy Computational Science Graduate Fellowship
Dissertation: "Adaptive Model Reduction to Accelerate Optimization Problems Governed by Partial Differential Equations"

June 2016 **M.S., Computational and Mathematical Engineering, Stanford University** *Stanford, CA*
Advisor: Charbel Farhat

May 2011 **B.S., Civil and Environmental Engineering, University of California, Berkeley** *Berkeley, CA*
Minor: Mathematics; Advisor: Sanjay Govindjee

Honors & Awards

Jun 2017 **Gene Golub Dissertation Award**, Stanford University *Stanford, CA*
Recognition for best ICME thesis in 2016-2017 academic year

2016–2018 **Luis W. Alvarez Postdoctoral Fellowship**, Lawrence Berkeley National Laboratory *Berkeley, CA*
2 year, independent research fellowship

2016–2018 **Sydney Fernbach Postdoctoral Fellowship**, Lawrence Livermore National Laboratory *Livermore, CA*
2 year, independent research fellowship (declined)

Apr 2015 **Robert J. Melosh Medal Finalist**, Duke University *Durham, NC*
Best student paper in finite element analysis

2011–2015 **Department of Energy Computational Science Graduate Fellowship**
4 years - full tuition, stipend, and research allowance

May 2011 **University Medal Finalist**, University of California, Berkeley *Berkeley, CA*
Campus-wide award to most distinguished graduating senior

Feb 2017 **Early Career Travel Award**
SIAM Conference on Computational Science and Engineering (February 2017)

2013–2016 **Student Travel Award**
International Meshing Roundtable (September 2016) · SIAM Conference on Uncertainty Quantification (April 2016) · World Congress on Computational Mechanics XI (July 2014) · International Conference on Spectral and Higher-Order Methods (June 2014) · SIAM Conference on Optimization (May 2014) · San Diego Supercomputing Summer Institute, HPC Workshop (August 2013)

May 2011 **Civil Engineering Department Citation**, University of California, Berkeley *Berkeley, CA*
Department-wide award to most distinguished student

Aug 2010 **Best Project Award, 2010 AHPCRC Summer Institute Presentation**, Stanford University *Stanford, CA*

Apr 2010 **Structural Engineers Association of N. California (SEAONC) Scholarship**

May 2009 **Louise Cooper Endowment**, University of California, Berkeley *Berkeley, CA*
Ranked 1st in CEE department

Aug 2009 **Best Overall Project, 2009 Young Researchers Symposium**

Grants & Funding

Research

2016–2018 *Enabling Extreme-Scale Many-Query Computational Physics: An adaptive framework for optimization and uncertainty quantification of multiphysics applications* (Principal Investigator), $232500, Laboratory Directed Research and Development, Lawrence Berkeley National Laboratory, *Awarded*.

2016–2018 *Enabling Extreme-Scale Many-Query Computational Physics: An adaptive framework for optimization and uncertainty quantification of multiphysics applications* (Principal Investigator), $300000, Laboratory Directed Research and Development, Lawrence Livermore National Laboratory, *Awarded but declined*.

Education

2016–2017 *Advanced MATLAB programming for scientific computing* (Principal Investigator), $40000, Development of Massively Open Online Course (MOOC), MathWorks, *Awarded*.

Publications

Thesis

[1] M. J. Zahr, *Adaptive Model Reduction to Accelerate Optimization Problems Governed by Partial Differential Equations*. PhD thesis, Stanford University, August 2016

Book Chapter

[2] M. J. Zahr and P.-O. Persson, "Energetically optimal flapping wing motions via adjoint-based optimization and high-order discretizations," in *Frontiers in PDE-Constrained Optimization*, Springer, 2018

Journal

[3] D. Z. Huang, W. Pazner, P.-O. Persson, and M. J. Zahr, "High-order partitioned spectral deferred correction solvers for multiphysics problems," *in preparation*, 2019

[4] J. Töger, M. J. Zahr, K. Markenroth Bloch, M. Carlsson, and P.-O. Persson, "Towards 4D flow magnetic resonance imaging reconstruction constrained by the Navier-Stokes equations," *Magnetic Resonance in Medicine*, in review 2018

[5] D. Z. Huang, P.-O. Persson, and M. J. Zahr, "High-order, linearly stable, partitioned solvers for general multiphysics problems based on implicit-explicit Runge-Kutta schemes," *Computer Methods in Applied Mechanics and Engineering*, vol. 346, pp. 674 – 706, 2018

[6] M. J. Zahr, K. Carlberg, and D. P. Kouri, "Adaptive stochastic collocation for PDE-constrained optimization under uncertainty using sparse grids and model reduction," *SIAM Journal on Uncertainty Quantification*, in press 2019

[7] M. J. Zahr and P.-O. Persson, "An optimization-based approach for high-order accurate discretization of conservation laws with discontinuous solutions," *Journal of Computational Physics*, vol. 365, pp. 105 – 134, 2018

[8] M. J. Zahr, P. Avery, and C. Farhat, "A multilevel projection-based model order reduction framework for nonlinear dynamic multiscale problems in structural and solid mechanics," *International Journal for Numerical Methods in Engineering*, vol. 112, no. 8, pp. 855–881, 2017

[9] M. J. Zahr, P.-O. Persson, and J. Wilkening, "A fully discrete adjoint method for optimization of flow problems on deforming domains with time-periodicity constraints," *Computers & Fluids*, vol. 139, pp. 130 – 147, 2016

[10] M. J. Zahr and P.-O. Persson, "An adjoint method for a high-order discretization of deforming domain conservation laws for optimization of flow problems," *Journal of Computational Physics*, vol. 326, no. Supplement C, pp. 516 – 543, 2016

[11] M. J. Zahr and C. Farhat, "Progressive construction of a parametric reduced-order model for PDE-constrained optimization," *International Journal for Numerical Methods in Engineering*, vol. 102, no. 5, pp. 1111–1135, 2015

[12] D. Amsallem, M. J. Zahr, and K. Washabaugh, "Fast local reduced basis updates for the efficient reduction of nonlinear systems with hyper-reduction," *Advances in Computational Mathematics*, pp. 1–44, 2015

[13] D. Amsallem, M. J. Zahr, Y. Choi, and C. Farhat, "Design optimization using hyper-reduced-order models," *Structural and Multidisciplinary Optimization*, pp. 1–22, 2014

[14] D. Amsallem, M. J. Zahr, and C. Farhat, "Nonlinear model order reduction based on local reduced-order bases," *International Journal for Numerical Methods in Engineering*, vol. 92, no. 10, pp. 891–916, 2012

Conference

[15] D. Z. Huang, P.-O. Persson, and M. J. Zahr, "A high-order partitioned solver for general multiphysics problems and its applications in optimization," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech2019)*, (San Diego, California), American Institute of Aeronautics and Astronautics, 1/7/2019 – 1/11/2019

[16] M. Franco, P.-O. Persson, W. Pazner, and M. J. Zahr, "An adjoint method using fully implicit Runge-Kutta schemes for optimization of flow problems," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech2019)*, (San Diego, California), American Institute of Aeronautics and Astronautics, 1/7/2019 – 1/11/2019

[17] A. Shi, P.-O. Persson, and M. J. Zahr, "An optimization-based discontinuous Galerkin approach for high-order accurate shock tracking with guaranteed mesh quality," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech2019)*, (San Diego, California), American Institute of Aeronautics and Astronautics, 1/7/2019 – 1/11/2019

[18] M. J. Zahr and P.-O. Persson, "An optimization-based discontinuous Galerkin approach for high-order accurate shock tracking," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech2018)*, (Kissimmee, Florida), American Institute of Aeronautics and Astronautics, 1/8/2018 – 1/12/2018

[19] J. Wang, M. J. Zahr, and P.-O. Persson, "Energetically optimal flapping flight based on a fully discrete adjoint method with explicit treatment of flapping frequency," in *Proc. of the 23rd AIAA Computational Fluid Dynamics Conference*, (Denver, Colorado), American Institute of Aeronautics and Astronautics, 6/5/2017 – 6/9/2017

[20] M. J. Zahr and P.-O. Persson, "High-order, time-dependent aerodynamic optimization using a discontinuous Galerkin discretization of the Navier-Stokes equations," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech 2016)*, (San Diego, California), 1/4/2016 – 1/8/2016

[21] D. De Santis, M. J. Zahr, and C. Farhat, "Gradient-based aerodynamic shape optimization using the FIVER embedded boundary method," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech 2016)*, (San Diego, California), 1/4/2016 – 1/8/2016

[22] K. Washabaugh, M. J. Zahr, and C. Farhat, "On the use of discrete nonlinear reduced-order models for the prediction of steady-state flows past parametrically deformed complex geometries," in *Proc. of the AIAA Science and Technology Forum and Exposition (SciTech 2016)*, (San Diego, California), 1/4/2016 – 1/8/2016

[23] M. J. Zahr and P.-O. Persson, "Performance tuning of Newton-GMRES methods for discontinuous Galerkin discretizations of the Navier-Stokes equations," in *Proc. of the 21st AIAA Computational Fluid Dynamics Conference*, vol. AIAA-2013-2685, American Institute of Aeronautics and Astronautics, 6/24/2013 – 6/27/2013

[24] M. J. Zahr, D. Amsallem, and C. Farhat, "Construction of parametrically-robust CFD-based reduced-order models for PDE-constrained optimization," in *Proc. of the 21st AIAA Computational Fluid Dynamics Conference*, vol. AIAA-2013-2685, American Institute of Aeronautics and Astronautics, 6/24/2013 – 6/27/2013

[25] K. Washabaugh, D. Amsallem, M. J. Zahr, and C. Farhat, "Nonlinear model reduction for CFD problems using local reduced-order bases," in *Proc. of the 42nd AIAA Fluid Dynamics Conference and Exhibit, Fluid Dynamics and Co-located Conferences*, vol. 2686, 6/25/2012 – 6/28/2012

[26] D. Amsallem, M. J. Zahr, and C. Farhat, "On the robustness of residual minimization for constructing POD-based reduced-order CFD models," in *Proc. of the 43rd AIAA Fluid Dynamics Conference and Exhibit*, (San Diego, California), 6/27/2011 – 6/30/2011

[27] K. Carlberg, J. Cortial, D. Amsallem, M. J. Zahr, and C. Farhat, "The GNAT nonlinear model reduction method and its application to fluid dynamics problems," in *AIAA Paper 2011-3112, 6th AIAA Theoretical Fluid Mechanics Conference*, (Honolulu, Hawaii), 6/27/2011 – 6/30/2011

Technical Report

[28] M. J. Zahr and S. Govindjee, "Theoretical and numerical foundations for the use of microcolumns as angular motion sensors," tech. rep., University of California, Berkeley, 2011

[29] M. J. Zahr, K. Carlberg, D. Amsallem, and C. Farhat, "Comparison of model reduction techniques on high-fidelity linear and nonlinear electrical, mechanical, and biological systems," tech. rep., University of California, Berkeley, 2010

[30] M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile reinforced concrete buildings using seismic risk maps," tech. rep., United States Geologic Survey (USGS), 2009

Research mentoring

Ph.D. students supervised

2019–pres **Tianshu Wen**, *Ph.D., Aerospace and Mechanical Engineering, University of Notre Dame*
Project: Adaptive model reduction to accelerate optimization problems governed by partial differential equations

2019–pres **Tianci Huang**, *Ph.D., Aerospace and Mechanical Engineering, University of Notre Dame*
Project: Topology optimization using adaptive reduced-order models

2018–pres **Marzieh Mirhoseini**, *Ph.D., Aerospace and Mechanical Engineering, University of Notre Dame*
Project: Optimization-based, high-order accurate resolution of shocks

Other graduate students

2019–pres **Han Gao**, *Ph.D., Aerospace and Mechanical Engineering, University of Notre Dame*
Project: Non-intrusive nonlinear model reduction using machine learning

2018–pres **Robert Baraldi**, *Ph.D., Applied Mathematics, University of Washington*
Department of Energy Computational Science Graduate Fellowship (DOE CSGF) Practicum
Project: Efficient Bayesian inversion using adaptive model reduction and sparse grids

2018–pres **Andrew Shi**, *Ph.D., Mathematics, University of California, Berkeley*
Project: An optimization-based, high-order accurate discretization of interface problems using an Arbitrary Lagrangian-Eulerian formulation and moving mesh

2017–2019 **Zhengyu Huang**, *Ph.D., Computational and Mathematical Engineering, Stanford University*
Project: A high-order partitioned solver for general multiphysics problems and the corresponding fully discrete sensitivity and adjoint methods

2017–pres **Jingyi Wang**, *Ph.D., Mechanical Engineering, University of California, Berkeley*
Project: Energetically optimal flapping flight based on a fully discrete adjoint method with explicit treatment of flapping frequency
Project: High-order topology optimization

Smr 2018 **Aditya Kiran**, *Ph.D., Mathematics, University of South Carolina*
National Science Foundation Mathematical Sciences Graduate Internship (NSF-MSGI)
Project: Optimization-based, high-order accurate resolution of moving shocks using a space-time formulation

Aut 2018 **Anran Lu**, *M.S., Computational and Mathematical Engineering, Stanford University*
Project: Optimization-based model reduction

Aut 2018 **Yiwen Guo**, *M.S., Computational and Mathematical Engineering, Stanford University*
Project: Optimization-based model reduction

Smr 2018 **Michael Franco**, *Ph.D., Mathematics, University of California, Berkeley*
Project: Fully discrete adjoint method for fully implicit, stage-parallel Runge-Kutta schemes

Spr 2018 **Kexin Yu**, *M.S., Computational and Mathematical Engineering, Stanford University*
Project: Implementation and study of hyperreduction methods for nonlinear model reduction with pyMORTestbed

AY 2018 **Remmelt Ammerlaan**, *M.S., Computational and Mathematical Engineering, Stanford University*
Project: Implementation and study of hyperreduction methods for nonlinear model reduction with pyMORTestbed
Project: Optimization-based model reduction

Spr 2016 **Gabriele Boncoraglio**, *M.S., Aeronautics and Astronautics, Stanford University*
Project: Accelerating PDE-constrained optimization with partially converged solutions and model reduction

Aut 2015 **Christina White**, *M.S., Mechanical Engineering, Stanford University*
Project: Machine learning algorithms in model order reduction

Undergraduate students

Smr 2019 **Tung Nguyen**, *B.A., Mathematics, Wabash College*
Project: Design optimization of cardiovascular stents

Smr 2015 **Fredrick Earnest**, *B.S., Mechanical and Aerospace Engineering, New Mexico State University*
Undergraduate Research Intern, Army High Performance Computing Research Center, Stanford University
Project: Projection-based model order reduction for nonlinearly constrained contact

Smr 2014 **Joseph Graff**, *B.S., Mechanical and Aerospace Engineering, New Mexico State University*
Undergraduate Research Intern, Army High Performance Computing Research Center, Stanford University
Project: Automated mesh generation and validation for CFD analysis and shape optimization

Smr 2014 **Zach Nevills**, *B.S., Mechanical Engineering, Stanford University*
Undergraduate Research Intern, Army High Performance Computing Research Center, Stanford University
Project: Automated mesh generation and validation for CFD analysis and shape optimization

Smr 2014 **Harry Pham**, *B.S., Mechanical Engineering, Stanford University*
Undergraduate Research Intern, Army High Performance Computing Research Center, Stanford University
Project: Implementation of an aeroelastic shape optimization driver
2nd Place, Best Project Award

Teaching

Spr 2019 **Finite Element Methods (AME 50541)**, University of Notre Dame
An introduction to the fundamental concepts of finite element methods with applications to structural analysis, heat flow, fluid mechanics, and coupled multiphysics problems. The course covers the basic topics of linear and nonlinear finite element technology including weak formulations and error analysis, domain discretization on structured and unstructured meshes, direct and integral approaches for assembly, the isoparametric concept, application of boundary conditions, numerical quadrature, variational crimes, the treatment of constraints, and the structure of a finite element program. Element technologies such as basic data structures, polynomial interpolation, and engineering elements (bars, beams, frames, and shells) are also discussed. Students build their own FEM program throughout the course and gain experience using commercial software.
Enrollment: 17 (Spr 2019)
Course website: http://mjzahr.github.io/teach-nd-ame50541-spr19.html

Spr 2017 **Model Reduction (CME 345)**, Stanford University
Presents the basic mathematical theory for projection-based model reduction. Topics include: notions of linear dynamical systems and projection; projection-based model reduction; error analysis; proper orthogonal decomposition; Hankel operator and balancing of a linear dynamical system; balancedtruncation method: modal truncation and other reduction methods for linear oscillators; model reduction via moment matching methods based on Krylov subspaces; introduction to model reduction of parametric systems and notions of nonlinear model reduction. Course material is complemented by a balanced set of theoretical, algorithmic, and programming assignments.
Enrollment: 17 (Spr 2017)
Course website: http://mjzahr.github.io/teach-stanford-cme345-spr17.html

Spr 2014
Aut 2014
Spr 2015 **Advanced MATLAB for Scientific Computing (CME 292)**, Stanford University
Intended to teach graduates students advanced MATLAB topics useful in research. Topics: advanced syntax, graphics, numerical linear algebra and optimization, object-oriented programming, file manipulation and system interaction, C/MATLAB interface through MEX, MATLAB Coder, toolboxes (symbolic, parallel, PDE). Applications drawn from scientific computing: linear algebra, optimization, solution of nonlinear systems of equations, polynomial interpolation, mesh generation, ODEs/PDEs, and fluid dynamics.
Enrollment: 11 (Spr 2015), 6 (Spr 2015), 16 (Spr 2015)
Award: Received $40k grant from MathWorks to convert course into MOOC
Course website: http://mjzahr.github.io/teach-stanford-cme292-spr15.html

Smr 2013 **Classical Solutions to Partial Differential Equations (CME 001)**, Stanford University
Refresher course intended to prepare first year ICME for upcoming coursework and qualifying exams
Enrollment: 30 (Smr 2013)
Course website: http://mjzahr.github.io/teach-stanford-cme001-smr13.html

Academic Service

Professional Memberships

Socitey for Industrial and Applied Mathematics. Since 2016.

American Institute of Aeronautics and Astronautics. Lifetime Membership. Since 2016.

Journal referee

Aerospace Science and Technology (AESCTE) · American Institute of Astronautics and Aeronautics (AIAA) Journal · Annual Reviews in Control (ARC) · Communications in Computational Physics (CiCP) · Computational Mechanics (CM) · Computer Methods in Applied Mechanics and Engineering (CMAME) · International Journal for Numerical Methods in Engineering (IJNME) · International Journal for Numerical Methods in Fluids (IJNMF) · Journal of Computational Physics (JCP) · Journal of Computational Science (JCS) · Journal of Computational and Applied Mathematics (JCAM) · Optimization and Engineering (OPTE) · SIAM Journal on Scientific Computing (SISC) · SIAM Journal on Uncertainty Quantification (JUQ) · Smart Science (SS)

Book chapter referee

Institute for Mathematics and its Applications (IMA)

Seminar organization

Applied Mathematics Seminar, *Lawrence Berkeley National Laboratory, University of California, Berkeley*. Organizers: M.J. Zahr, L. Lin, P. Persson. Aut 2017, Spr 2018, Aut 2018. http://math.lbl.gov/ams.

Workshop organization

2017 West Coast ROM Workshop, *Lawrence Berkeley National Laboratory*. Organizers: K. Carlberg, M.J. Zahr. November 17, 2017. http://math.lbl.gov/~mjzahr/wcrw2017/.

6th International Workshop on High Order CFD Methods - Test Cases with Shocks, *American Institute of Aeronautics and Astronautics Science and Technology Forum and Exposition 2021 (AIAA Scitech 2021)*. Organizers: T. Fisher, A. Corrigan, M.J. Zahr, C. Kim. January 8, 2021.

Minisymposium organization

Y. Choi, M. Yano, M.J. Zahr, "MS1001: Model order reduction for computational continuum mechanics," 15th U.S. National Congress on Computational Mechanics, Austin, Texas, July 28 – August 1, 2019

M.J. Zahr, W. Pazner, P. Persson, "MS365: High-order discontinuous Galerkin and finite element methods for CFD," SIAM Conference on Computational Science and Engineering, Spokane, WA, February 25 – March 1, 2019

F. Chinesta, E. Cueto, C. Farhat, M.J. Zahr, "Model Reduction, Big Data, and Dynamic Data-Driven Systems," World Congress on Computational Mechanics XIII (WCCM XIII), New York City, NY, July 22 – July 27, 2018

F. Chinesta, E. Cueto, C. Farhat, M.J. Zahr, "Model Reduction, Big Data, and Dynamic Data-Driven Systems," 6th European Conference on Computational Mechanics, 7th European Conference on Computational Fluid Dynamics, Glasgow, Scotland, UK, June 11 – June 15, 2018

A. Manzoni, M.J. Zahr, "MS145: Reduced order modeling techniques in large scale and data-driven PDE problems," SIAM Conference on Computational Science and Engineering, Atlanta, GA, February 27 – March 3, 2017

Conference session chair

Y. Choi, M. Yano, M.J. Zahr, "MS1001: Model order reduction for computational continuum mechanics," 15th U.S. National Congress on Computational Mechanics, Austin, Texas, July 28 – August 1, 2019

M.J. Zahr, W. Pazner, P. Persson, "MS365: High-order discontinuous Galerkin and finite element methods for CFD," SIAM Conference on Computational Science and Engineering, Spokane, WA, February 25 – March 1, 2019

F. Chinesta, E. Cueto, C. Farhat, M.J. Zahr, "Model Reduction, Big Data, and Dynamic Data-Driven Systems," 6th European Conference on Computational Mechanics, 7th European Conference on Computational Fluid Dynamics, Glasgow, Scotland, UK, June 11 – June 15, 2018

A. Manzoni, M.J. Zahr, "MS145: Reduced order modeling techniques in large scale and data-driven PDE problems," SIAM Conference on Computational Science and Engineering, Atlanta, GA, February 27 – March 3, 2017

M.J. Zahr, "MS: Applications of Computational Fluid Dynamics," 43rd AIAA Fluid Dynamics Conference and Exhibit, San Diego, CA, June 24–27, 2013

M.J. Zahr, "MS: Applications of Optimization," SIAM Conference on Optimization, San Diego, CA, May 19–22, 2014

Outreach

Mar 2016
Mar 2017
Mar 2018 **Central Catholic High School Career Day** *Modesto, CA*

Presentation: Computational methods to solve next-generation science and engineering grand challenge problems; A workshop intended to demonstrate the real-world impact of CSE, convey my excitement and passion for the field, and hopefully motivate a diverse group of students to consider a CSE career

Talks

Seminar (Invited)

- M. J. Zahr, "Integrated computational physics and numerical optimization," in *Program in Applied Mathematics Colloquium, University of Arizona*, (Tuscon, Arizona), University of Arizona, 9/21/2018
- M. J. Zahr, "Integrated computational physics and numerical optimization," in *Applied Mathematics Seminar, UC Berkeley*, (Berkeley, California), University of California, Berkeley, 9/6/2018
- M. J. Zahr, "Optimization-based computational physics and high-order methods: from optimized analysis to design and data assimilation," in *Aerospace and Ocean Engineering Seminar, Virginia Tech*, (Blacksburg, Virginia), Virginia Polytechnic Institute and State University, 4/2/2018
- M. J. Zahr, "Optimization-based computational physics and high-order methods: from optimized analysis to design and data assimilation," in *LBNL CRD Postdoc Seminar Series*, (Berkeley, California), Lawrence Berkeley National Laboratory, 9/18/2017

- M. J. Zahr, "Gradient-based optimization of flow problems using the adjoint method and high-order numerical discretizations," in *Applied, Computational, and Industrial Math Seminar Series*, (San Jose, California), San Jose State University, 5/8/2017
- M. J. Zahr and P.-O. Persson, "Optimization of CFD simulations, with MRI applications," in *TESLA Seminar*, (Lund, Sweden), Lund University, 3/31/2017
- M. J. Zahr, "Adaptive model reduction to accelerate optimization problems governed by partial differential equations," in *Farhat Research Group Seminar*, (Stanford, California), Stanford University, 1/10/2017
- M. J. Zahr, "Adaptive model reduction to accelerate optimization problems governed by partial differential equations," in *LBNL Postdoc Seminar Series*, (Berkeley, California), Lawrence Berkeley National Laboratory, 1/9/2017
- M. J. Zahr, "Adaptive model reduction to accelerate optimization problems governed by partial differential equations," in *Thesis Defense*, (Stanford, California), Stanford University, 8/3/2016
- M. J. Zahr, "Efficient PDE-constrained optimization under uncertainty using adaptive model reduction and sparse grids," in *CME 500 Seminar*, (Stanford, California), Stanford University, 4/11/2016
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *University of Notre Dame Aerospace and Mechanical Engineering Seminar (Host: Gretar Tryggvason)*, (South Bend, Indiana), University of Notre Dame, 3/3/2016 – 3/4/2016
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *University of Southern California Aerospace and Mechanical Engineering Seminar (Host: Geoff Spedding)*, (Los Angeles, California), University of Southern California, 2/25/2016 – 2/26/2017
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *Luis W. Alvarez Fellowship Seminar (Host: Jonathan Carter)*, (Berkeley, California), Lawrence Berkeley National Laboratory, 2/9/2016
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *J. H. Wilkinson Fellowship Seminar (Host: Sven Leyffer)*, (Argonne, Illinois), Argonne National Laboratory, 1/15/2016
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *John von Neumann Postdoctoral Fellowship Seminar (Host: Denis Ridzal)*, (Albuquerque, New Mexico), Sandia National Laboratories, 1/11/2016
- M. J. Zahr and P.-O. Persson, "High-order methods for optimization and control of conservation laws on deforming domains," in *Dean Seminar at Sandia National Laboratories (Host: Kevin Carlberg)*, (Livermore, California), 12/14/2015
- M. J. Zahr, "Accelerating PDE-constrained optimization problems using adaptive reduced-order models," in *Sidney Fernbach Postdoctoral Fellowship Seminar (Host: Jeffrey A. F. Hittinger)*, (Livermore, California), Lawrence Livermore National Laboratory, 12/9/2015
- M. J. Zahr, "High-order methods for optimization and control of conservation laws on deforming domains," in *Farhat Research Group Seminar*, (Stanford, California), Stanford University, 12/8/2015
- M. J. Zahr and P.-O. Persson, "High-order methods for optimization and control of conservation laws on deforming domains," in *Applied Mathematics Seminar at UC Berkeley (Host: Per-Olof Persson)*, (Berkeley, California), 9/30/2015
- M. J. Zahr and C. Farhat, "Accelerating PDE-constrained optimization using adaptive reduced-order models," in *Seminar at Sandia National Laboratories (Host: Drew Kouri)*, (Albuquerque, New Mexico), 7/8/2015
- M. J. Zahr, "Accelerating PDE-constrained optimization using adaptive reduced-order models: application to topology optimization," in *Robert J. Melosh Medal Competition*, (Durham, North Carolina), Duke University, 4/24/2015
- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *Seminar at USGS headquarters (Host: Nicolas Luco)*, (Golden, Colorado), 6/8/2010
- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *Undergraduate Research Seminar at UC Berkeley*, (Berkeley, California), 4/27/2010
- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *Seminar at USGS headquarters (Host: Nicolas Luco)*, (Golden, Colorado), 8/13/2009

Workshop (Invited)

- M. J. Zahr and P.-O. Persson, "An optimization-based discontinuous Galerkin approach for high-order accurate shock tracking," in *5th International Workshop on High-Order CFD Methods*, (Kissimmee, Florida), 1/8/2018 – 1/12/2018
- M. J. Zahr, "Efficient PDE-constrained optimization under uncertainty using adaptive model reduction and sparse grids," in *2017 West Coast ROM Workshop*, (Berkeley, California), Lawrence Berkeley National Laboratory, 11/17/2017

- M. J. Zahr, "Adjoint-based PDE-constrained optimization using globally high-order numerical discretizations," in *2017 Berkeley/Stanford Computational Mechanics Festival (CompFest)*, (Berkeley, California), University of California, Berkeley, 5/8/2017
- M. J. Zahr, "Efficient PDE-constrained optimization under uncertainty using adaptive model reduction and sparse grids," in *BIRS Workshop: Data-Driven Methods for ROMs and Stochastic PDEs*, (Banff, Alberta, Canada), Banff International Reseach Station, 1/30/2017 – 2/3/2017
- M. J. Zahr and C. Farhat, "A nonlinear trust-region framework for PDE-constrained optimization using adaptive model reduction," in *West Coast ROM Workshop*, (Livermore, California), Sandia National Laboratories, 11/19/2015
- M. J. Zahr and C. Farhat, "Accelerating PDE-constrained optimization using progressively constructed reduced-order models," in *Bay Area ROM Workshop*, (Livermore, California), Sandia National Laboratories, 8/8/2014
- M. J. Zahr, "Rapid topology optimization using reduced-order models," in *2013 Berkeley/Stanford Computational Mechanics Festival (CompFest)*, (Berkeley, California), University of California, Berkeley, 10/19/2013
- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *PEER Internship Summer Meeting*, (webcast), 8/18/2009

Conference

- M. J. Zahr, "An optimization-based approach for the reduction of conservation laws with parametrized discontinuities," in *15th U.S. National Congress on Computational Mechanics (USNCCM15)*, (Austin, Texas), 7/28/2019 – 8/2/2019
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