Matthew J. Zahr

Luis W. Alvarez Postdoctoral Fellow
Department of Mathematics
University of California, Berkeley
Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory
1 Cyclotron Road Mailstop 50A1148
Berkeley, CA 94720

(209) 652-1251
mjzahr@lbl.gov
http://math.lbl.gov/~mjzahr

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

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; GPA: 4.0
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; GPA: 4.15

May 2011   **B.S., Civil and Environmental Engineering, University of California, Berkeley**   *Berkeley, CA*
Minor: Mathematics; Advisor: Sanjay Govindjee; GPA: 3.99

Overview

19 papers: 8 journal, 10 conference, 1 book chapter

Luis W. Alvarez Postdoctoral Fellowship recipient (2016-2018)

Robert J. Melosh Medeal Finalist: best student paper in finite element analysis (2015)

Department of Energy Computational Science Graduate Fellowship recipient (2011–2015)

Designed, taught advanced MATLAB programming course (CME292) at Stanford University while a graduate student

1 education grant: $40k from MathWorks to convert CME292 into Massive Open Online Course (MOOC)

University Medal Finalist, UC Berkeley: ranked in top 5 of graduation class (2011)

Civil Engineering Department Citation, UC Berkeley: ranked 1st in CE department (2011)

Honors & Awards

Jun 2017   **Gene Golub Dissertation Award**, Stanford University   *Stanford, CA*

2016–2018   **Luis W. Alvarez Postdoctoral Fellowship**, Lawrence Berkeley National Laboratory   *Berkeley, CA*

Jun 2015   **MathWorks grant ($40k) to convert CME292 (Stanford University) into MOOC**

Apr 2015   **Robert J. Melosh Medal Finalist**, Duke University   *Durham, NC*

2011–2015   **Department of Energy Computational Science Graduate Fellowship**

May 2011   **University Medal Finalist**, University of California, Berkeley   *Berkeley, CA*

Feb 2017	**Early Career Travel Award**
2013–2016	**Student Travel Award**
May 2011	**Civil Engineering Department Citation**, University of California, Berkeley *Berkeley, CA*
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*
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

Education

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

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, 2017

Journal

[3] 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*, in review 2018

[4] 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*, 2017

[5] 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*, 2016

[6] 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

[7] 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

[8] 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

[9] 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

[10] 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

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

[12] 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

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

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

[15] 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 *AIAA Science and Technology Forum and Exposition (SciTech 2016)*, (San Diego, California), 1/4/2016 – 1/8/2016

[16] 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

[17] 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

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

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

[20] 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

[21] 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

[22] 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

[23] 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

TEACHING EXPERIENCE & RESEARCH MENTORING

CURRICULUM DEVELOPMENT AND INSTRUCTION

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

Spr 2014 **Advanced MATLAB for Scientific Computing (CME 292)**, Stanford University
Aut 2014 Intended to teach graduates students advanced MATLAB topics useful in research; Applications drawn from scientific computing: linear algebra and optimization, ODEs/PDEs, etc; *Award*: Received $40k grant from MathWorks to convert course into MOOC
Spr 2015

Spr 2017 **Model Reduction (CME 345)**, Stanford University
Presents the basic mathematical theory for projection-based model reduction

RESEARCH MENTORING

Smr 2018 **Robert Baraldi**, *Ph.D., Applied Mathematics, University of Washington*
Project: Efficient Bayesian inversion using adaptive model reduction and sparse grids

Smr 2017 **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

Spr 2017 **Jingyi Wang**, *Ph.D., Mechanical Engineering, University of California, Berkeley*
Project: Frequency

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

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

ACADEMIC SERVICE

JOURNAL REFEREE

American Institute of Astronautics and Aeronautics (AIAA) Journal · Annual Reviews in Control (ARC) · Computer Methods in Applied Mechanics and Engineering (CMAME) · International Journal for Numerical Methods in Engineering (IJNME) · Journal of Computational Physics (JCP) · Journal of Computational Science (JCS) · Journal of Computational and Applied Mathematics (JCAM) · Optimization and Engineering (OPTE)

BOOK CHAPTER REFEREE

Institute for Mathematics and its Applications (IMA)

CONFERENCE SESSION CHAIR

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

MINISYMPOSIUM ORGANIZATION

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

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. 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/.

OUTREACH ORGANIZATION

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

WORK EXPERIENCE

Jun 2015 –   **Research intern**   *Livermore, CA*
Sep 2015   Extreme-Scale Data Science and Analytics Department, Sandia National Laboratories
Project: PDE-constrained optimization under uncertainty using model reduction and sparse grids

Jun 2012 –   **Research intern**   *Berkeley, CA*
Sep 2012   Department of Mathematics, Lawrence Berkeley National Laboratory
Project: Performance tuning for discontinuous Galerkin methods

| Jan 2011 – May 2011 | **Book reviewer** | *Berkeley, CA* |
| | Department of Mechanical Engineering, University of California, Berkeley | |

Reviewed and edited two books written by Prof Tarek Zohdi prior to publication

- T. I. Zohdi, *Electromagnetic Properties of Multiphase Dielectrics: A Primer on Modeling, Theory and Computation*, vol. 64. Springer Science & Business Media, 2012
- T. I. Zohdi, *Dynamics of Charged Particulate Systems: Modeling, Theory and Computation*. Springer Science & Business Media, 2012

| Jun 2010 – Sep 2010 | **Research intern** | *Stanford, CA* |
| | Department of Aeronautics and Astronautics, Stanford University | |

Project: MORTestbed: A testbed for the comparison of model order reduction techniques on benchmark problems

| Jun 2009 – Aug 2009 | **Research intern** | *Golden, CO* |
| | Geologic Hazards Team, United States Geological Survey | |

Project: Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps

Talks

Seminar

- 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*, (Lunda, 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 Carterl)*, (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

- 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 and P.-O. Persson, "Adjoint-based optimization of time-dependent fluid-structure systems using a high-order discontinuous Galerkin discretization," in *14th U.S. National Congress on Computational Mechanics (USNCCM14)*, (Montreal, Quebec, Canada), 7/17/2017 – 7/20/2017

- M. J. Zahr and P.-O. Persson, "Adjoint-based optimization of time-dependent fluid-structure systems using a high-order discontinuous Galerkin discretization," in *VII International Conference on Coupled Problems in Science and Engineering*, (Rhodes Island, Greece), 6/12/2017 – 6/14/2017

- M. J. Zahr and P.-O. Persson, "Energetically optimal flapping flight based on a high-order discontinuous Galerkin discretization of the Navier-Stokes equations," in *23rd AIAA Computational Fluid Dynamics Conference*, (Denver, Colorado), 6/5/2017 – 6/9/2017

- M. J. Zahr and P.-O. Persson, "Adjoint-based optimization of time-dependent fluid-structure systems using a high-order discontinuous Galerkin discretization," in *IACM 19th International Conference on Finite Element in Flow Problems (FEF)*, (Rome, Italy), 4/5/2017 – 4/7/2017

- M. J. Zahr and P.-O. Persson, "Adjoint-based optimization of time-dependent fluid-structure systems using a high-order discontinuous Galerkin discretization," in *European Workshop on High Order Nonlinear Numerical Methods for Evolutionary PDEs: Theory and Applications*, (Stuttgart, Germany), University of Stuttgart, 3/27/2017 – 3/31/2017

- M. J. Zahr, K. Carlberg, and D. P. Kouri, "Efficient PDE-constrained optimization under uncertainty using adaptive model reduction and sparse grids," in *SIAM Conference on Computational Science and Engineering*, (Atlanta, Georgia), 2/27/2017 – 3/3/2017

- M. J. Zahr, K. Carlberg, and D. P. Kouri, "Efficient PDE-constrained optimization under uncertainty using adaptive model reduction and sparse grids," in *SIAM Annual Meeting*, (Boston, Massachusetts), 7/11/2016 – 7/15/2016

○ M. J. Zahr, K. Carlberg, and D. P. Kouri, "Adaptive stochastic collocation for PDE-constrained optimization under uncertainty using sparse grids and model reduction," in *SIAM Conference on Uncertainty Quantification*, (Lausanne, Switzerland), Ecole Polytechnique Federale de Lausanne, 4/5/2016 – 4/8/2016

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

○ 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 *AIAA Science and Technology Forum and Exposition (SciTech 2016)*, (San Diego, California), 1/4/2016 – 1/8/2016

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

○ M. J. Zahr, "High-order, time-dependent PDE-constrained optimization using discontinuous Galerkin methods," in *Department of Energy Computational Science Graduate Fellowship Program Review*, (Washington D.C.), 7/27/2015 – 7/30/2015

○ M. J. Zahr and P.-O. Persson, "Unsteady CFD optimization using high-order discontinuous Galerkin finite element methods," in *13th U.S. National Congress on Computational Mechanics (USNCCM13)*, (San Diego, California), 7/26/2015 – 7/30/2015

○ M. J. Zahr and C. Farhat, "A nonlinear trust-region framework for PDE-constrained optimization using progressively constructed reduced-order models," in *2015 SIAM Conference on Computational Science and Engineering (CSE15)*, (Salt Lake City, Utah), 3/14/2015 – 3/18/2015

○ M. J. Zahr and C. Farhat, "PDE-constrained optimization using progressively constructed reduced-order models," in *World Congress on Computational Mechanics XI (WCCM XI)*, (Barcelona, Spain), 7/20/2014 – 7/25/2014

○ M. J. Zahr, K. Washabaugh, and C. Farhat, "Robust reduced-order models via fast, low-rank basis updates," in *2014 SIAM Annual Meeting*, (Chicago, Illinois), 7/7/2014 – 7/11/2014

○ M. J. Zahr and P.-O. Persson, "Hyperreduced models for discontinuous Galerkin finite element methods," in *International Conference on Spectral and High Order Methods (ICOSAHOM)*, (Salt Lake City, Utah), 6/23/2014 – 6/27/2014

○ M. J. Zahr and C. Farhat, "Rapid nonlinear topology optimization using precomputed reduced-order models," in *17th US National Congress on Theoretical and Applied Mechanics (USNCTAM)*, (East Lansing, Michigan), 6/15/2014 – 6/20/2014

○ M. J. Zahr and C. Farhat, "PDE-constrained optimization using hyper-reduced models," in *SIAM Conference on Optimization*, (San Diego, California), 5/19/2014 – 5/22/2014

○ M. J. Zahr and C. Farhat, "Rapid nonlinear topology optimization using reduced-order models," in *12th U.S. National Congress on Computational Mechanics (USNCCM12)*, (Raleigh, North Carolina), 7/22/2013 – 7/25/2013

○ M. J. Zahr, D. Amsallem, and C. Farhat, "Construction of parametrically robust CFD-based reduced-order models for PDE-constrained optimization," in *43rd AIAA Fluid Dynamics Conference and Exhibit*, (San Diego, California), 6/24/2013 – 6/27/2013

○ M. J. Zahr and P.-O. Persson, "Performance tuning of Newton-GMRES methods for discontinuous Galerkin discretizations of the Navier-Stokes equations," in *43rd AIAA Fluid Dynamics Conference and Exhibit*, (San Diego, California), 6/24/2013 – 6/27/2013

○ D. Amsallem, M. J. Zahr, Y. Choi, and C. Farhat, "Design optimization using hyper-reduced order models," in *10th World Congress on Structural and Multidisciplinary Optimization (WCSMO10)*, (Orlando, Florida), 3/19/2013 – 3/24/2013

○ M. J. Zahr and C. Farhat, "Construction of parametrically robust reduced-order models for PDE-constrained optimization," in *10th World Congress on Structural and Multidisciplinary Optimization (WCSMO10)*, (Orlando, Florida), 3/19/2013 – 3/24/2013

○ D. Amsallem, K. Washabaugh, M. J. Zahr, and C. Farhat, "Efficient nonlinear model reduction approach using local reduced bases and hyper-reduction," in *2013 SIAM Conference on Computational Science and Engineering (CSE13)*, (Boston, Massachusetts), 2/25/2013 – 3/1/2013

○ M. J. Zahr and C. Farhat, "Efficient, parametrically robust nonlinear model reduction using local reduced-order bases," in *2013 SIAM Conference on Computational Science and Engineering (CSE13)*, (Boston, Massachusetts), 2/25/2013 – 3/1/2013

○ D. Amsallem, M. J. Zahr, and C. Farhat, "Nonlinear model order reduction with local reduced-order bases for hyper-reduction," in *Proceedings of the 2012 European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS)*, (Vienna, Austria), 9/10/2012 – 9/14/2012

○ D. Amsallem, C. Farhat, and M. J. Zahr, "Real-time CFD-based fluid-structure predictions using a database of parameterized reduced-order models," in *10th World Congress on Computational Mechanics (WCCM X)*, (Sao Paolo, Brazil), 7/8/2012 – 7/13/2012

- 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 *6th AIAA Theoretical Fluid Mechanics Conference*, (Honolulu, Hawaii), 6/27/2011 – 6/30/2011

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

POSTER

- M. J. Zahr and P.-O. Persson, "Adjoint-based optimization, uncertainty quantification, and data assimilation of multiphysics systems using high-order numerical discretizations," in *DOE ASCR Applied Mathematics PI Meeting*, (Washington D.C.), 9/11/2017 – 9/12/2017

- M. J. Zahr, "Efficient PDE-constrained optimization using adaptive model reduction," in *Institute for Mathematics and its Applications: Frontiers in PDE-Constrained Optimization*, (Minneapolis, Minnesota), 6/6/2016 – 6/10/2016

- M. J. Zahr, "Efficient PDE-constrained optimization using adaptive model reduction," in *2016 Stanford Computational Mathematics and Engineering Affiliates Meeting*, (Stanford, California), 5/1/2016

- M. J. Zahr, "Efficient PDE-constrained optimization using adaptive model reduction," in *2016 Stanford Aerospace and Astronautics Affiliates Meeting*, (Stanford, California), 4/26/2016

- M. J. Zahr and C. Farhat, "Accelerating PDE-constrained optimization using adaptive reduced-order models," in *Army High Performance Computing Research Center (AHPCRC) Review Meeting*, (Santa Cruz, California), 1/18/2016 – 1/20/2016

- M. J. Zahr, P. Avery, and C. Farhat, "A hyperreduced FE^2 method for real-time multiscale simulations," in *Army High Performance Computing Research Center (AHPCRC) Review Meeting*, (Santa Cruz, California), 1/18/2016 – 1/20/2016

- M. J. Zahr and C. Farhat, "Accelerating PDE-constrained optimization using progressively-constructed reduced-order models," in *Army High Performance Computing Research Center (AHPCRC) Review Meeting*, (Santa Cruz, California), 8/10/2015 – 8/12/2016

- M. J. Zahr and P.-O. Persson, "Unsteady PDE-constrained optimization using high-order DG-FEM," in *13th U.S. National Congress on Computational Mechanics (USNCCM13)*, (San Diego, California), 7/26/2015 – 7/30/2015

- M. J. Zahr and C. Farhat, "Progressive construction of a parametric reduced-order model for PDE-constrained optimization," in *2014 DOE CSGF Annual Program Review*, (Washington D.C.), 7/14/2014 – 7/17/2014

- M. J. Zahr, "PDE-constrained optimization using progressively constructed reduced-order models," in *2014 Stanford Aerospace and Astronautics Affiliates Meeting*, (Stanford, California), 4/28/2014

- M. J. Zahr and C. Farhat, "Rapid topology optimization using reduced-order models," in *2013 DOE CSGF Annual Program Review*, (Washington D.C.), 7/25/2013 – 7/27/2013

- M. J. Zahr and C. Farhat, "Rapid structural shape optimization using progressively constructed reduced-order models," in *12th U.S. National Congress on Computational Mechanics (USNCCM12)*, (Raleigh, North Carolina), 7/22/2013 – 7/25/2013

- M. J. Zahr and C. Farhat, "Design of fluid mechanical systems using reduced-order models," in *2012 DOE CSGF Annual Program Review*, (Washington D.C.), 7/26/2012 – 7/28/2012

- M. J. Zahr, C. Farhat, K. Carlberg, and D. Amsallem, "Comparison of model reduction techniques on linear and nonlinear electrical, mechanical, and biological systems," in *UC Berkeley Undergraduate Research Poster Session*, (Berkeley, California), 4/19/2011

- M. J. Zahr, C. Farhat, K. Carlberg, and D. Amsallem, "Comparison of model reduction techniques on linear and nonlinear electrical, mechanical, and biological systems," in *2011 SIAM Conference on Computational Science and Engineering (CSE11)*, (Reno, Nevada), 3/1/2011

- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *2009 PEER Annual Meeting*, (San Francisco, California), 10/15/2009 – 10/16/2009

- M. J. Zahr, N. Luco, and H. Ryu, "Mitigation of seismic risk pertaining to non-ductile concrete buildings using seismic risk maps," in *2009 Young Researcher's Symposium*, (Buffalo, New York), 8/20/2009 – 8/22/2009

TECHNICAL SKILLS

C++, MATLAB, Python programming · Unix, LaTeX · COMSOL, Finite Element Analysis Program (FEAP), SAP 2000 · MPI, OpenMP parallelism · AutoCAD

OTHER INTERESTS

boxing · hiking · weightlifting · downhill skiing · running