Shiguang Deng

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Education

Ph.D. Mechanical Engineering, University of Wisconsin-Madison, 2012-2016
- Advisor: Professor Krishnan Suresh
- Thesis: Augmented Topological Level-Set for Large-Scale Thermo-Elastic Topology Optimization

M.S. Mechanical Engineering, University of Wyoming, 2009-2012
- Advisor: Professor Mark Garnich
- Thesis: Dynamic Progressive Damage Modeling of Strain Rate Effects Upon Tensile Deformation of Fiber-reinforced Composites

B.S. Chemical Engineering, Hefei University of Technology (China), 2005-2009
- Thesis: Thermal Property Analysis of Phase Change Materials for Energy Storage Applications

Professional Appointment

Research Associate, Mechanical Engineering, Northwestern University, 2023-Now
- Advisors: Professor Wei Chen (NAE) and Professor Horacio D. Espinosa (NAE)
- Project: Data-Driven Metamaterials Design for Advanced Manufacturing

Postdoctoral Researcher, Material Science & Engineering, University of California-Irvine, 2019-2022
- Advisors: Professor Diran Apelian (NAE) and Professor Ramin Bostanabad
- Project: Data-Driven Modeling of Multiscale Metallic Alloys with Tomography-Infused Manufacturing-Induced Porosity Distribution

Research Engineer, Team of Design Optimization, MSC Nastran, CA, 2016-2019
- Project 1: Design, develop, test, and maintain topology optimization solvers on the MSC's generative design platform for additive manufacturing
- Project 2: Develop machine learning surrogates for Nastran FEA solutions

Publication

Journal Articles

- [J1] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Multi-constrained topology optimization via the topological sensitivity." *Structural and Multidisciplinary Optimization* 51 (2015): 987-1001.
- [J2] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Multi-constrained 3D topology optimization via augmented topological level-set." *Computers & Structures* 170 (2016): 1-12.
- [J3] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Topology optimization under thermo-elastic buckling." *Structural and Multidisciplinary Optimization* 55 (2017): 1759-1772.
- [J4] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Stress constrained thermo-elastic topology optimization with varying temperature fields via augmented topological sensitivity-based level-set." *Structural and Multidisciplinary Optimization* 56 (2017): 1413-1427.
- [J5] <u>Deng, Shiguang</u>, Carl Soderhjelm, Diran Apelian, and Krishnan Suresh. "Estimation of elastic behaviors of metal components containing process induced porosity." *Computers & Structures* 254 (2021): 106558.
- [J6] <u>Deng, Shiguang</u>, Carl Soderhjelm, Diran Apelian, and Krishnan Suresh. "Second order defeaturing estimator of manufacturing-induced porosity on structural elasticity." *International Journal of Numerical Methods in Engineering*, 123.19 (2022): 4483-4517.

- [J7] <u>Deng, Shiguang</u>, Carl Soderhjelm, Diran Apelian, and Ramin Bostanabad. "Reduced-order multiscale modeling of plastic deformations in 3D alloys with spatially varying porosity by deflated clustering analysis." *Computational Mechanics*, 70 (2022): 517-548.

- [J8] <u>Deng, Shiguang</u>, Diran Apelian, and Ramin Bostanabad. "Adaptive spatiotemporal dimension reduction in concurrent multiscale damage analysis." *Computational Mechanics* (special issue on machine learning theories, modeling, and applications to computational materials science) 72 (2023): 3-35.

- [J9] <u>Deng, Shiguang</u>, Carlos Mora, Diran Apelian and Ramin Bostanabad. "Data-driven calibration of multi-fidelity multiscale fracture models via latent map Gaussian process." *Journal of Mechanical Design*, 145.1 (2023): 011705.

- [J10] <u>Deng, Shiguang</u>, Shirin Hosseinmardi, Diran Apelian and Ramin Bostanabad. " Physics-informed recurrent neural networks for multiscale damage modeling.", *Computational Mechanics* (2023), under review.

Peer Reviewed Conference Articles

- [C1] <u>Deng, Shiguang</u>, Carlos Mora, Diran Apelian and Ramin Bostanabad. "Multi-fidelity reduced-order models for multiscale damage analyses with automatic calibration." *ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, St. Louis, MO, August 2022.

- [C2] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Topology optimization of linear thermo-elastic buckling problem via augmented topological level-set." *ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, Charlotte, NC, August 2016.

- [C3] <u>Deng, Shiguang</u>, and Krishnan Suresh. "Predicting the Benefits of Topology Optimization." *ASME 2015 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, Boston, MA, August 2015.

- [C4] <u>Deng, Shiguang</u>, Krishnan Suresh, and James Joo. "Stress-Constrained Thermo-Elastic Topology Optimization: A Topological Sensitivity Approach." *ASME 2014 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, Buffalo, NY, August 2014.

- [C5] Garnich, Mark, Ray Fertig, Evan Anderson, and <u>Deng, Shiguang</u>. "Micromechanics of fatigue damage in unidirectional polymer composites." *Structural Dynamics and Materials Conference 20th AIAA/ASME/AHS Adaptive Structures Conference*, Honolulu, HI, April 2012.

Patent

- "Pareto technology", No. P160229US01 USA, co-authored with Prof. Krishnan Suresh, licensed by Wisconsin Alumni Research Foundation, and commercialized as ParetoWorks software

Funding Proposal

Main contributor

- "Predicting the Benefits of Topology Optimization", NSF-CMMI, PI: Dr. Krishnan Suresh (UWM), award number 1824980 (2018-2021), amount: $262,942, publication: [C3]

- "Machine Learning Enhanced Multiscale Simulation of Fiber Composites", NSF-OAC, PI: Dr. Ramin Bostanabad (UCI), award number 2103708 (2021-2023), amount: $175,000, publication: [J7]

- "Uncertainty Quantification for Multiscale Multiphysics Problems", DOE-ASCR, PI: Dr. Ramin Bostanabad (UCI), under review, publication: [J8]

Teaching & Mentoring
Teaching Assistant
- Optimum Design of Mechanical Elements and Systems (ME 748), Fall 2014, University of Wisconsin
- Advanced Finite Element Analysis (ME 5475), Fall 2010, University of Wyoming
- Manufacturing of Composites (ME 3450), Spring, 2010, University of Wyoming
- Introduction to Solid Mechanics (ME 5000), Fall 2009, University of Wyoming

Research Mentoring
- Tyler Johnson (Ph.D. student at University of California Irvine)
- Carlos Mora Sardina (Ph.D. student at University of California Irvine), Publication: [J9]
- Shirin Hosseinmardi (Ph.D. student at University of California Irvine), Publication: [J10]

Presentation
- "Adaptive spatiotemporal dimension reduction in concurrent multiscale damage analysis", Sandia Machine Learning and Deep Learning (MLDL) Workshop, virtual, 2023
- "Multi-Fidelity Reduced-Order Models for Multiscale Damage Analyses with Automatic Calibration", ASME IDETC-CIE, St. Louis, Missouri, 2022
- "Reduced-Order Multiscale Modeling of Elasto-Plastic Cast Alloys with Process-Induced Porosity", TMS, Anaheim, CA, 2022
- "Reduced-Order Multiscale Materials Modeling with Tomography Infused Porosity Distributions", USNCCM16, virtual, 2021
- "Multiscale Simulation of Aluminum Alloys with Deflated Clustering Analysis", ACRC, UCI, 2021
- "Data-driven Multiscale Modeling with Spatially Varying Porosity Distributions", ACRC, UCI, 2020
- "Incorporation of High-Quality Porosity Data in FEA Models", WPI, ACRC, MA, 2019
- "Topology optimization under thermo-elastic buckling", ASME IDETC-CIE, Charlotte, NC, 2016
- "Predicting the Benefits of Topology Optimization", ASME IDETC-CIE, Boston, MA, 2015
- "Stress-Constrained Thermo-Elastic Topology Optimization", ASME IDETC-CIE, Buffalo, NY, 2014
- "Topological Sensitivity Methods for Stiffening Plate Structures." WACC, Madison, WI, 2013

Award
- Chester E. & Flora Jane Leroy Fellowship, University of Wisconsin-Madison, 2012
- Outstanding undergraduate scholarship, Hefei University of Technology, 2007

Service
- **Conference organizer:** Mini-symposium organizer of MMLDE-CSET 2023.
- **Journal reviewer:** Journal of Mechanical Design, Structural and Multi-Disciplinary Optimization, Computer Aided Design, Computational Mechanics, Engineering Optimization, International Journal for Numerical Methods in Engineering, Virtual and Physical Prototyping, Journal of Computing and Information Science in Engineering, International Journal of Applied Mechanics, Journal of Advances in Computational Design, International Journal of Precision Engineering and Manufacturing

Shiguang Deng

Computer Skill

- Programming language: Python, Matlab, C++/C, Fortran, TensorFlow, Keras
- High performance computing: CUDA (GPU), OpenMP (multi-core CPU)
- Data analysis: Google Colab, SQL, R, Azure, Tableau, Power BI
- CAE software: Abaqus, Ansys, Nastran, SolidWorks, AutoCAD

Website

- Research page: https://sdeng9.github.io/
- Google scholar: https://scholar.google.com/citations?user=UggIrFoAAAAJ&hl=en
- LinkedIn: https://www.linkedin.com/in/shiguang-deng-5a944473/

Work Authorization

- US permanent residence: authorized to work for any US employer without VISA sponsorship

References

- **Professor Wei Chen**
  2145 Sheridan Road, B222
  Northwestern University, Evanston, IL 60208
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- **Professor Diran Apelian**
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- **Professor Ramin Bostanabad**
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- **Professor Krishnan Suresh**
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