# SIDDHARTHA SRIVASTAVA

*Curriculum Vitae*
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3003 EECS, 1301 Beal Ave
Ann Arbor, MI-48109

sidsriva@umich.edu
(+1)734-846-6136

## APPOINTMENTS

**Assistant research scientist, University of Michigan**                   *Dec 2022 - present*

*Mentors*: Prof. Krishna Garikipati, Prof Xun Huan

**Research fellow, University of Michigan**                   *May 2021 - Nov 2022*

*Advisor*: Prof. Krishna Garikipati

**Project Engineer, IIT Kanpur**                   *May-Dec 2015*

*Research Project*: Phase field modeling of fracture in highly deformable materials

*Advisor*: Prof. Chandra S. Upadhyay

**Intern, Industrieanlagen-Betriebsgesellschaft mbH (iABG), Germany**      May-July 2012

*Supervisor*: Dr. Orlando da Costa

## EDUCATION

**University of Michigan**                   *2016 - 2021*

Ph.D., Aerospace Engineering

*Dissertation*:   Graph-theoretic algorithms adaptable to Quantum computing
*Advisor*:       Prof. Veera Sundararaghavan

M.S., Mathematics

M.S.E., Aerospace Engineering

**Indian Institute of Technology Kanpur**                   *2010 - 2015*

B.Tech - M.Tech dual degree, Aerospace Engineering

*Dissertation*:   Constitutive modeling of rubber-like materials
*Advisor*:       Prof. Chandra S. Upadhyay

## AREAS OF INTEREST

Scientific learning methods, Computational mechanics, Biomechanics, Graph-theoretic algorithms, Post-Moore computation.

## JOURNAL PUBLICATIONS

1. Duschenes M, **Srivastava S**, Garikipati K. "Numerical analysis of non-local calculus on finite weighted graphs, with application to reduced-order modelling of dynamical systems". Computer Methods in Applied Mechanics and Engineering, 115513

2. Nikolov DP, **Srivastava S**, Abeid BA, Scheven UM, Arruda EM, Garikipati K, Estrada JB.(2022) "Ogden Material Calibration via Magnetic Resonance Cartography, Parameter Sensitivity, and Variational System Identification". Philosophical Transitions of the Royal Society. A.38020210324

3. **Srivastava S** and Sundararaghavan V. (2022)"Bandgap optimization in combinatorial graphs with tailored ground states: Application in Quantum annealing". Optimization and Engineering, 1-19.

4. Zhang X, Teichert GH, Wang Z, Duschenes M, **Srivastava S**, Livingston E, Holber J, Shojaei MF, Sunderarajan A, Garikipati K." mechanoChemML: A software library for machine learning in computational materials physics". Computational Materials Science, 211, 111493.

5. **Srivastava S**, Yaghoobi M, and Sundararaghavan V (2020). "A graph-theoretic approach for multiscale modeling and prediction of crack propagation in polycrystalline materials".Engineering Fracture Mechanics, 107406.

6. **Srivastava S**, Sundararaghavan V, (2020). "Graph coloring approach to mesh generation in multiphase media with smooth boundaries".AIAA Journal, 58(1), pp.198-205.

7. **Srivastava S**, and Sundararaghavan V (2019). "Box algorithm for the solution of differential equations on a quantum annealer". Physical Review A 99.5 : 052355.

8. Acosta KL, **Srivastava S**, Wilkie WK, Inman DJ (2019). "Primary and secondary pyroelectric effects in macro-fiber composites". Composites Part B: Engineering, 177, 107275.

9. Lakshmanan A, **Srivastava S**, Ramazani A, Sundararaghavan V (2018). "Thermal conductivity of pillared graphene-epoxy nanocomposites using molecular dynamics". Applied Physics Letters, 112(15), 151902.

10. Sundararaghavan V, **Srivastava S** (2017). "MicroFract: An image based code for microstructural crack path prediction". SoftwareX, 6, 94-97.

11. Acar P, **Srivastava S**, and Sundararaghavan V (2017)."Stochastic Design Optimization of Microstructures with Utilization of a Linear Solver". AIAA Journal, Vol. 55, No. 9, pp. 3161-3168.

## PREPRINTS

\* Manuscript available on request

1. **Srivastava S**, Livingston E, Duschenes M, Garikipati K. "Graph Calculus Neural Network".

2. Ho KH, **Srivastava S**, Kinnunen PC, Garikipati K, Luker GD, Luker KE. "Cell-to-cell variability of dynamic CXCL12-CXCR4 signaling and morphological processes in chemotaxis". bioRxiv. doi:10.1101/2022.05.19.492090

3. **Srivastava S**, and Sundararaghavan V. "Machine learning in quantum computers via general Boltzmann Machines: Generative and Discriminative training through annealing". arXiv:2002.00792

4. Javaheri I, **Srivastava S** and Sundararaghavan V. "White Paper - Physics-Based Segmentation of Synthetic Polycrystalline Microstructures using Graph Cuts".

5. Yaghoobi M, **Srivastava S**, Adams J, Greely D, Spear A, Allison J, Jones J and Sundararaghavan V. "A graph-theoretic approach for Fatigue crack prediction in Mg alloy".

## PEER-REVIEWED CONFERENCE PUBLICATIONS

1. Folk T, **Srivastava S**, Price D, Garikipati K and Kochunas B, *"Analytic Error Analysis of Cross Section Interpolation Methods in Nodal Diffusion Codes-I: Theory"*, PHYSOR, May 2022.

2. Folk T, **Srivastava S**, Price D, Garikipati K and Kochunas B, *"Analytic Error Analysis of Cross Section Interpolation Methods in Nodal Diffusion Codes-II: Numerical Results"*, PHYSOR, May 2022.

3. Price D, Folk T, **Srivastava S**, Garikipati K and Kochunas B, *"Sensitivity Analysis of Homogenized Cross-Sections in AP1000® Lattice with Burnable Poison"*, PHYSOR, May 2022.

4. **Srivastava S**, Sundararaghavan V, *"An integer programming approach for mesh generation for polycrystals using the EBSD map"*, AIAA Scitech, San Diego, January 2019.

5. Acar P, **Srivastava S** and Sundararaghavan V, *"Stochastic Design Optimization of Microstructures with Utilization of a Linear Solver"*, AIAA Scitech Forum, Gaylord, Texas, January 2017.

6. **Srivastava S**, Verma A, Dwivedi A and Abhishek, *"Charactarization of vibration absorber for mounting sensors on Micro Air Vehicle"*, 8$^{th}$ ICIUS, Singapore, October 2012.

7. Dwivedi A, **Srivastava S** and Abhishek,*" Development of Auto Takeoff and Landing System for a Coaxial MAV"*, 8$^{th}$ ICIUS, Singapore, October 2012.

## RESEARCH RESOURCES

1. **Srivastava S**, Garikipati K, Livingston E, *"Large scale computation for data-generation with application to inverse modeling of the fetal brain, and reduced-order modeling of cardiovascular flows"*. Extreme Science and Engineering Discovery Environment: Urbana, Illinois, US. `https://xras.xsede.org/public/requests/47046-XSEDE-BIO220054`

## CONFERENCES

1. Garikipati K, **Srivastava S**, Huang C, Shen W, Kinnunen P, Ho K, Wang Z, Luker G, Luker K, Linderman J, Huan X. *"Machine Learning of the physics governing cell dynamics"*, presented in SES, College Station, Texas, October 2022.

2. **Srivastava S**, Wang Z, Nikolov DN, Abeid BA, Scheven UM, Arruda EM, Weickenmeier J, Estrada JB, Garikipati K. (**Invited**) *"Data-Driven Approach to Discovery of Physical Mechanisms in Biomechanical Systems"*, presented in SES, College Station, Texas, October 2022.

3. **Srivastava S**, Huang C, Shen W, Kinnunen P, Ho K, Wang Z, Luker G, Luker K, Linderman J, Huan X, Garikipati K. *"Discovery of Cell Migration Models by Data Driven Variational System Identification and Inverse Reinforcement Learning"*, presented in WCCM/APCOM, Online, August 2022.

4. Nikolov DN, **Srivastava S**, Abeid BA, Scheven UM, Arruda EM, Garikipati K, Estrada JB. *"Inference of Deformation Mechanisms, Constitutive Response, and Experimental Efficacy Using Variational System Identification with Magnetic Resonance Cartography"*, presented in USNCTAM 19, Austin, Texas, July 2022.

5. **Srivastava S**, Duschenes M, Livingston E, Garikipati K. *"Reduced-order models using non-local calculus on unstructured weighted graphs"*, presented in USNCTAM 19, Austin, Texas, July 2022.

6. **Srivastava S**, Duschenes M, Livingston E, Garikipati K. *"Non-local calculus on graphs with application to reduced order modeling"*, presented in Midwest Numerical Analysis Day, Ann Arbor Michigan, May 2022.

7. Wang Z, Estrada J, Arruda E, Garikipati K, **Srivastava S**, *"Discovery of deformation mechanisms and Constitutive Response of Biological Tissue by Data-Driven Variational System Identification"*, presented in USNCCM 16, Online, July 2021.

8. **Srivastava S**, Sundararaghavan V, (**Invited**), *"PRISMS Center Annual Workshop"*, presented at PRISMS Center Annual Workshop, University of Michigan, Ann Arbor, August 2021.

9. **Srivastava S** (**Invited**), *"Graph-theoretic methods in computational mechanics adaptable to Quantum annealers"*, presented at California State University, Long Beach, March 2021.

10. **Srivastava S**, Sundararaghavan V, *"A quantum annealing approach for learning Boltzmann machines as function approximators"*, presented in WCCM/ECCOMAS, Online, Jan 2021.

11. **Srivastava S**, Lakshmanan A, Sundararaghavan V, *"Behavior of Frustrated Antiferromagnets in Random Field"*, $15^{th}$ USNCCM/ECOMAS, Austin, July 2019.

12. Sundararaghavan V, **Srivastava S** (**Keynote**), *"Solving differential equations on a quantum annealer"*, $16^{th}$ PACAM, Ann Arbor, May 2019.

13. **Srivastava S**, Javaheri I, Sundararaghavan V, *"3D reconstruction of microstructure from surface images using graph theoretic approaches"*, TMS Forum, San Antonio, March 2019.

14. Javaheri I, **Srivastava S**, Sundararaghavan V, *"3D Microstructure Reconstruction using Markov Random Fields: Validation of Microstructural Features"*, presented in TMS Forum, San Antonio, Texas March 2019.

15. **Srivastava S**, Sundararaghavan V, *"Anisotropic crack path prediction in polycrystalline materials using graph theoretic approaches"*, $10^{th}$ ESMC, Bologna, Italy, July 2018.

16. **Srivastava S**, Upadhyay CS, Khan AS, Kitey R, *"Experimental Investigation and Constitutive Modelling of Rubber-like Materials"*, $9^{th}$ ESMC, Madrid, Spain, July 2015.

17. **Srivastava S**, Khan AS, *"Experimental Investigation and Constitutive Modelling of Rubber-like Materials"*, Research scholars day, Department of Aerospace Engineering, IIT Kanpur, April 2015.

## POSTER PRESENTATION

1. **Srivastava S**, Sundararaghavan V, *"Differential equations on D-Wave Architecture"*, presented in Michigan Quantum Science and Technology Workshop, Ann Arbor, Michigan, April 2019.

2. **Srivastava S**, Sundararaghavan V, *"Box algorithm for the solution of differential equations on a quantum annealer"*, MICDE 2019 Annual Symposium, Ann Arbor, Michigan, April 2018.

3. **Srivastava S**, Sundararaghavan V, *"Microfract: An image based code for micro-crack path prediction for multi-phase materials"*, TMS Forum, Phoenix, Arizona, March 2018.

## TEACHING

### University of Michigan

- Aircraft and Spacecraft Structures, Graduate Student Instructor (WN 18', FA 19', WN 20', SS 20', FA 20')
- Finite Element method, Lectures on Numerical integration schemes (WN 20')
- Mechanical Behavior of Materials, Lectures on Elastic properties of materials, Mechanisms of plastic deformations, Strengthening mechanisms, Fatigue, and Composite materials (FA 22')

### Indian Institute of Technology Kanpur

- Experiments in structures, Teaching assistant (SP 14')
- Aerospace summer workshop, Introductory lecture on " Elasticity" and "MATLAB" (SU 14')

## REVIEW SERVICE

- Reviewer, SciPy 2022 (Scientific Computing with Python), *Sessions: (i) Materials & Chemistry, (ii) Machine Learning & Data Science*

- Reviewer, Computer Methods in Applied Mechanics and Engineering

- Panel Judge, Advanced Graduate Research session, Engineering Research Symposium, 2021
- Reviewer, Outstanding Postdoctoral Fellow Award 2021, Rackham Graduate School

## OUTREACH

- Mini-symposium co-chair for WCCM/ECCOMAS, Jan 2021, *Session: New Computational Frontiers in Microstructure-Sensitive Materials Design*

- **Society of Aerospace Engineers, IIT Kanpur**
    - President (14')
    - Head of Science and Technology (13')

- **Aerospace summer workshops, IIT Kanpur**
    - Re-entry Vehicle design using Ablative Materials, Session organizer (SU 14')
    - Wing Box Design and Analysis, Session organizer (SU 12')

## MEDIA COVERAGE

Hemsoth, Nicole. "Where will Quantum systems succeed in AI Training?" The Next Platform, Stackhouse Publishing PlatformStack Inc, 10 Feb 2020, `https://www.nextplatform.com/2020/02/10/where-will-quantum-systems-succeed-in-ai-training/`.

## AWARDS AND ACHIEVEMENTS

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|---|---|
| *Certificates*: | – Rackham Professional Development Diversity, Equity, and Inclusion Certificate (2022) |
| *Research Grant*: | – Principal Investigator for XSEDE Research grant (NSF) for computational resources (estimated value: $ 22,255.00). |
| | – Awarded 100 hour computation time on the Quantum Computer in the USRA-NASA-Google Quantum Artificial Intelligence Laboratory at NASA's Ames Research Center. |
| *Scholarships*: | – Merit-based scholarship for graduate assistantship in Aerospace Dept. at IIT Kanpur covering monthly stipend for 1 year. |
| | – Merit and proposal based Boeing-IITK scholarship covering monthly stipend for 4 months. |
| *Travel Grants*: | – 3 Rackham travel grants to attend USNCCM, ESMC and TMS conferences. |
| | – 2 Dean of Research and Alumni to attend ESMC and ICIUS conferences. |

## REFERENCES

1. Prof. Krishna Garikipati
   Professor, University of Michigan
   krishna@umich.edu

2. Prof. Veera Sundararaghavan
   Professor, University of Michigan
   veeras@umich.edu

3. Prof. Shiva Rudraraju
   Assistant Professor, University of Wisconsin-Madison
   shiva.rudraraju@wisc.edu

4. Prof. Pinar Acar
   Assistant Professor, Virginia Polytechnic Inst. & State University
   pacar@vt.edu

5. Prof. Xun Huan
   Assistant Professor, University of Michigan
   xhuan@umich.edu