Aaditya **Chandrasekhar**

Doctoral Candidate · Mechanical Engineering

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Summary

I am a Doctoral candidate in Mechanical Engineering at UW Madison, advised by Prof. Krishnan Suresh. My research explores incorporating physics constraints in Machine Learning; primarily for design optimization. My current research includes mechanics driven Neural Networks for Topology Optimization, selection of material and the design of multi-material components, imposing Additive Manufacturing constraints such as build orientation, path optimization for continuous fiber AM, length scale control in designs.

I am currently seeking a research scientist position with interests involving Machine Learning for Engineering, design optimization and Additive Manufacturing.

Education

University of Wisconsin - Madison *Madison, WI, USA*

PhD (pursuing) in Mechanical Engineering *Jan. 2016 - Exp. July 2022*

SRM Institute of Science and Technology, Chennai *Chennai, India*

B.Tech in Mechanical Engineering *2011 - 2015*

Work Experience

PARC Xerox *Cary, NC, USA*

Intelligent Systems Lab Research Intern *May. 2021 - Aug. 2021*

- Worked on algorithms to optimize continuous fiber reinforced composites designs.
- Developed algorithms to represent, optimize, and on-the-Fly correction of print paths using sequential Neural Networks

Teaching Experience

Introduction to Design Optimization (ME 548), Spring 2020 *Madison, WI, USA*

Teaching Assistant under Prof. Krishnan Suresh *Jan. 2020 - May 2020*

- Conducted discussions. Aided with regular lectures, content preparation, setting exams and grading.

Computer Aided Engineering (ME 331), Fall 2019 *Madison, WI, USA*

Teaching Assistant under Jeff Roessler *Sep. 2019 - Dec. 2019*

- Conducted tutorials and discussions. Lab sessions included teaching SolidWorks- theory and practical. Aided with regular lectures, setting exams and grading.

Awards and Recognitions

Myers Wisconsin Distinguished Graduate Fellow *2021*

Grainger Wisconsin Distinguished Graduate Fellow *2020*

Publications

A Physics and Data Driven Neural Network Approach for Multiscale Topology Optimization *In Progress*

Aaditya Chandrasekhar and Krishnan Suresh *2022*

- Construct a data-driven differentiable latent representation of microstructures using Variational Autoencoders.
- Optimize macroscale topology by interfacing with microstructure's latent space via physics-driven design optimization.

A Neural Network Framework for the Topology Optimization of Continuous Fiber Reinforced Composites *In Progress*

Aaditya Chandrasekhar, Amir Mirzendehdel, Morad Behandish, Saketh Sridhara and Krishnan Suresh *2022*

- Simultaneous optimization of topology and continuous fiber orientation and concentration.
- Neural Net representation enables us to represent and extract continuous fibers.

Integrating Material Selection with Design Optimization via Neural Networks *Under Review*

Aaditya Chandrasekhar, Saketh Sridhara and Krishnan Suresh *2022*

- Construct a data-driven differentiable representation of material properties.
- Optimize designs by simultaneously choosing material and geometry via physics-driven design optimization.

Length Scale Control in Topology Optimization using Fourier Enhanced Neural Networks *Under Review*

Aaditya Chandrasekhar and Krishnan Suresh *2021*

- Enables length scale control in designs through projecting coordinates to frequency space.
- Extract smooth differentiable boundaries at sub-element length scales

AuTO: Automatic Differentiation for Sensitivity Analysis in Topology Optimization *SAMO*

Aaditya Chandrasekhar, Saketh Sridhara and Krishnan Suresh *2021*

- Overcome the need to manually derive and implement sensitivity expressions in topology optimization.
- Applied automatic differentiation for compliance minimization, compliant mechanism design and microstructural design in JAX.

Multi-Material Topology Optimization Using Neural Networks *CAD*

Aaditya Chandrasekhar and Krishnan Suresh *2021*

- Extends the TOuNN framework to handle designing with multiple materials.
- Computationally efficient method to obtain checkerboard-free designs.

TOuNN: Topology Optimization using Neural Networks *SAMO*

Aaditya Chandrasekhar and Krishnan Suresh *2020*

- Directly execute topology optimization using neural networks.
- Impose design and manufacturing constraints within the proposed framework are described.

Build optimization of Fiber-Reinforced Additively Manufactured Components *SAMO*

Aaditya Chandrasekhar, Tej Kumar, Krishnan Suresh *2019*

- Optimization of the build direction, topology, and fiber orientation of AM Short Fiber Composites.
- Effect of layer-wise printing on anisotropic material properties was considered.

Towards Assembly-Free Methods for Additive Manufacturing Simulation *ASME-IDETC*

Anirudh Krishnakumar, Aaditya Chandrasekhar, Krishnan Suresh *2015*

- Increase simulation speed for modelling transient thermo-mechanical interactions during Additive Manufacturing.
- Extended assembly-free finite element analysis to nonlinear physics models.

Conferences & Talks

Optimization of Support Structure for AM Via Pseudo-Fiber Material Model

Topology Optimization Roundtable, Albuquerque, NM *2019*

Build Optimization of Fiber Reinforced 3D-Printed Components

World Congress for Computational Mechanics, New York, NY *2018*

Limited-memory assembly free finite element simulation of fused deposition modeling

United States National Congress on Computational Mechanics, Montreal, Canada *2017*

A Memory-efficient Finite Element Simulation to Predict Warping in Metal AM

Solid Freeform Symposium, Austin, TX *2016*

Exploratory Projects

Design and Analysis of 3D Printed Heat Exchangers *DOE Project*

Supervised by Prof. Krishnan Suresh

- Improve the thermal efficiency of additively manufactured dry-cooled condensers by reducing the air-side thermal resistance.
- Performed stress and thermal analysis to assess the feasibility of proposed designs and suggested design modifications.

Slicing on a GPU *Course Project*

CS 759

- Implemented 3D printer slicing algorithms on multi-core CPU and GPU.
- Evaluated performance gains and identified core algorithms that accelerate performance.

Parametric Solid Modeling *Course Project*

ME 535

- Developed a lightweight command based parametric solid modeling tool in Python.
- Explored design optimization of parametric solids using the tool.

Software Skills

Languages

Primary: C++, Python, MATLAB. Secondary: Java, Julia, CUDA

Modeling & Analysis

SolidWorks, Ansys, Comsol, Rhino