# Athul Chakkithara Dharmarajan

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## EDUCATION

**Purdue University** West Lafayette, IN

PhD, Mechanical Engineering Aug 2022–Present

Relevant Courses: Intro to Data Mining, Analysis and Design of Robotic Manipulators, Linear Algebra with Applications, Advanced Mathematics for Engineers and Physicists, Introduction to Scientific Machine Learning, Advanced Scientific Machine Learning

**Indian Institute of Technology Bombay (IITB)** Mumbai, India

Master of Technology, Mechanical Engineering Jul 2021–Jun 2022

Bachelor of Technology, Mechanical Engineering Jul 2017–Jun 2021

## AWARDS AND HONORS

- ASME Computers and Information in Engineering Division (CIE) Graduate Student Travel Award Aug 2024
- Innovative Presentation Award, ASME CIE SciTechBuzz Summit, Washington D.C. Aug 2024
- Top 2 in the Systems Engineering Research Center (SERC) Trusted AI Challenge Aug 2024
- National Science Foundation Frontiers in Design Representation Travel Fellowship Jun 2023, Jun 2024
- Engineering Excellence Scholarship, School of Mechanical Engineering, Purdue University Aug 2022

## RESEARCH EXPERIENCE

**Research Assistant, Design Engineering Lab Purdue** **West Lafayette, IN**

Systems Engineering Research Center (SERC) Trusted Artificial Intelligence Challenge May 2024–Present

- Led a seven-membered student team from Purdue University in the competition among SERC partner universities
- Conceptualized decision-making architectures for navigating terrain with mines using unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs) with Artificial Intelligence (AI) based mine detection system

Quantitative Model for Design Performance May 2023–Present

- Developed a cognitive psychology-based explanatory model for predicting design performance
- Modeled the relationship between factors responsible for expertise of designers and the performance of designs created

Theory Grounded Guidelines for Solver-aware System Architecting Aug 2022–Present

- Constructed a probabilistic generative model for estimating the performance of solvers with varying expertise
- Demonstrated working of model for design of the Astrobee robotic arm in the International Space Station (ISS)

**Research Assistant, Control and Coordination lab IITB** **Mumbai, India**

Multi-Agent Paradigm for Disaster Management May 2021–Jun 2022

- Created a novel scheme to assign area equitably among agents in coverage of a nonlinear environment
- Developed a collaborative path planning scheme to achieve the optimal coverage configuration without a central coordinator

## TECHNICAL PROJECTS

Generating Designs using Denoising Diffusion Probabilistic Models (DDPM) in JAX Jan 2024–May 2024

- Built a JAX implementation of the DDPM for generating parametric ship hull designs under constraints
- Leveraged different neural network architectures like U-net, ResNet for the DDPM

Predicting Sales Using Machine Learning-based Time Series Forecasting Jan 2021–May 2021

- Predicted sales of products in Walmart Stores across the USA using time series forecasting techniques
- Compared the performance of ARIMA, a Statistical model, and LGBM, a modern Gradient Boosting based method

Classification of Mushrooms using Data Mining Aug 2022–Nov 2022

- Compared different classifying algorithms for binary classification on a dataset of American mushrooms
- Utilized techniques like support vector machines (SVM), k-nearest neighbors, naïve Bayes, and decision trees

## PUBLICATIONS

Google Scholar: https://scholar.google.com/citations?user=LssYeuUAAAAJ&hl=en

1. **Dharmarajan, Athul Chakkithara**, Taylan G. Topcu, Jitesh H. Panchal, and Zoe Szajnfarber. "Valuing Outliers: A Modeling Framework to Consider Non-Traditional Solutions from Non-Traditional Solvers." American Society of Mechanical Engineers Digital Collection, 2024. https://doi.org/10.1115/DETC2024-143509.
2. Dadhich, Ruchika, Abhishek Singh, Anjana P. Menon, Manjari Mishra, **C. D. Athul**, and Shobhna Kapoor. "Biophysical Characterization of Mycobacterial Model Membranes and Their Interaction with Rifabutin: Towards Lipid-Guided Drug Screening in Tuberculosis." Biochimica et Biophysica Acta (BBA)-Biomembranes 1861, no. 6 (2019): 1213–27.
3. **Dharmarajan, Athul Chakkithara**. "Multi-Agent Paradigm for Disaster Management." Indian Institute of Technology Bombay, 2022. (Dissertation)

## ORAL PRESENTATIONS

1. **Dharmarajan, Athul C.** "Expertise in Engineering Design: A Predictive Modeling Framework for Performance." PechaKucha Presentation presented at the CIE SciTechBuzz Summit 2024, August 26, 2024.
2. **Dharmarajan, Athul C.** "Theory-Grounded Guidelines for Solver-Aware System Architecting (SASA)." SERC Doctoral Student Forum 2022, November 17, 2022. https://sercuarc.org/event/sdsf-2022/#dharmarajan (Virtual)

## POSTER PRESENTATIONS

1. **Dharmarajan, Athul C**, and Jitesh H Panchal. "Expertise in Engineering Design: A Predictive Modeling Framework for Performance." Poster presented at the CIE Graduate Student Poster Symposium 2024, Washington D.C., August 26, 2024.
2. **Dharmarajan, Athul Chakkithara**, Vikranth Sagar Reddy, Oladele Adeyeye, Taylan Topcu, Jitesh Panchal, and Zoe Szajnfarber. "A Function Selection-Based Framework for Representing Extreme Novelty in Product Design Models." November 6, 2023.
3. **Dharmarajan, Athul Chakkithara**, Taylan G. Topcu, Jitesh H. Panchal, and Zoe Szajnfarber. "Theory-Grounded Guidelines for Solver-Aware System Architecting (SASA)." SERC Doctoral Student Forum 2022, November 17, 2022. https://sercuarc.org/event/sdsf-2022/#dharmarajan.

## LEADERSHIP/SERVICE

Outreach Chair, Official Mechanical Engineering Graduate Association, Purdue University May 2024–Present

- Organized events to engage with the graduate student community and the broader community in the Lafayette area

Global Ambassador, Graduate School, Purdue University Nov 2023–Present

- Represented the graduate school in events and assisted in the recruitment of international students

Editorial Board Member, Insight IIT Bombay Apr 2019–Apr 2020

- Managed a team of 7 responsible for preparing online articles and printed newsletters for the university student media body

## TEACHING

Teaching Assistant:

ME 541 - Engineering Design: A Decision-Based Approach Fall 2024

ME 310 - Microprocessor and Automatic Controls Lab Spring 2022

ME 311 - Microprocessor and Automatic Controls Fall 2021

CH107 - Physical Chemistry Fall 2018

## PROFESSIONAL AFFILIATIONS

Student Member, ASME 2024 – present

## SKILLS

Programming tools: PyTorch, JAX, Matlab, C++, R; Software: AutoCAD, Fusion 360