

# AKASH YADAV

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## INTERESTS

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Uncertainty Quantification, Scientific Machine Learning, Digital Twins, System Identification

## EDUCATION

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**Doctor of Philosophy in Civil Engineering (CGPA: 4.0/4.0)** 08/2023 - present

Thesis: Quantifying and Reducing Model-form Uncertainty using Stochastic Subspaces  
*University of Houston - Houston, USA*

**Master of Technology (Research) in Civil Engineering (CGPA: 8.3/10)** 10/2020 - 06/2023

**Thesis:** SHM accounting for Thermal Variability and Damage using ABC  
*Indian Institute of Science - Bangalore, India*

**Bachelors of Technology in Civil Engineering (First Division, CGPA: 8.75/10)** 07/2014 - 05/2018

Thesis: Design of Hydro Power Project  
*Indian Institute of Technology - Roorkee, India*

## SKILLS

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**Programming Languages & Packages**  
**Computational Softwares**

Python, MATLAB, Julia, TensorFlow, PyTorch  
ABAQUS, LS-DYNA, Midas Civil, STAAD.Pro

## ACADEMIC PROJECTS

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**Correcting Model-form Uncertainty - Mentor: Dr. Ruda Zhang** 06/2024 - present

Developing a probabilistic framework for modeling stochastic subspaces to correct model-form uncertainty in computational mechanics and improve predictive performance under uncertainty.

**Characterizing Model-form Uncertainty - Mentor: Dr. Ruda Zhang** 08/2023 - 03/2025

Developed a probabilistic framework for constructing stochastic subspaces using probabilistic principal component analysis (SS-PPCA) and a bootstrap-based (SS-Bootstrap) data-driven technique to characterize model-form uncertainty and enhance the accuracy of structural simulations in computational mechanics.

**Bayesian Optimization under Uncertainty - Mentor: Dr. Ruda Zhang** 07/2024 - 02/2025

Developed a Bayesian optimization framework under uncertainty to improve the training of a concentration parameter in stochastic models, including SS-PPCA and SS-Bootstrap. The method reduced data requirements and accelerated hyperparameter training by a factor of 40.

**Uncertainty Quantification in PINNs - Rice University** 10/2024 - 12/2024

Explored a GAN-augmented Physics-Informed Neural Networks (PINNs) framework for uncertainty quantification, inspired by Yang et al. (2019).

**Structural Health Monitoring using ABC - Mentor: Dr. Ananth Ramaswamy** 07/2021 - 06/2023

Developed a method based on Approximate Bayesian Computation (ABC) for damage detection under varying temperature conditions, and extended it to capture damage-induced nonlinearity.

**Design of Hydro Power Project - IIT Roorkee** 07/2017 - 05/2018

Designed key structural components of a dam, including the cofferdam, spillway, sluiceway, and radial gates. Performed Finite Element Analysis using ABAQUS, evaluated slope stability with Geo5, and verified dam stability in accordance with IS 6512:1984 standards.

## RESEARCH PUBLICATIONS

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1. **Yadav, A** & Zhang R, Stochastic subspace via probabilistic principal component analysis for characterizing model error. (under review)
2. **Yadav, A** & Zhang R, Bayesian optimization under Uncertainty for Training a Concentration Parameter in Stochastic Models. (Draft completed)
3. **Yadav, A** & Zhang R, Stochastic subspace via Bootstrap for characterizing model error. (under preparation)

## ACADEMIC PRESENTATIONS

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1. **A. Yadav** & R. Zhang, Stochastic subspace via bootstrap for model-form uncertainty, *Conference on Applied AI & Scientific Machine Learning (CASML)*, IISc, Bangalore, India, December 14-18, 2024.
2. **A. Yadav** & R. Zhang, Stochastic subspace via probabilistic principal component analysis for model-form uncertainty, *16<sup>th</sup> World Congress on Computational Mechanics & 4<sup>th</sup> Pan American Congress on Computational Mechanics (WCCM/PANACM)*, Vancouver, Canada, July 21-26, 2024.
3. **A. Yadav** & R. Zhang, Stochastic subspace via probabilistic principal component analysis for model-form uncertainty, *Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference (EMI/PMC)*, Chicago, Illinois, USA, May 28-31, 2024.
4. **A. Yadav** & A. Ramaswamy, Structural health monitoring of steel truss bridges subjected to environmental variability, *8<sup>th</sup> International Congress on Computational Mechanics & Simulation (ICCMS)*, IIT, Indore, India, December 9-11, 2022.

## RELEVANT WORK EXPERIENCE

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### Graduate Research Assistant - University of Houston

08/2023 - present

Developing probabilistic and scientific machine learning methods to quantify and reduce model-form error in computational science and engineering.

### Senior Project Engineer - Indian Oil Corporation Limited

07/2018 - 09/2020

Oversaw the execution of an energy-efficient green building, a bridge over a green belt canal, and civil works for a new catalytic de-waxing unit.

### Industrial Internship - Rites Limited

Summer 2017, 2016

Designed highway bridge components, including superstructures and substructures, and performed finite element analysis of box culverts using Midas Civil. Designed retaining walls using both working stress and limit state methods, and applied IRC codes for culvert design using STAAD.Pro.

## TEACHING EXPERIENCE

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**Reciter** Mechanics-I Statics, University of Houston

08/2024 - 12/2024

**Teaching assistant** Mechanics-I Statics, University of Houston

08/2023 - 12/2023

## RELEVANT COURSEWORK

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A Practical Introduction to Deep Learning, Learning with Data, Data-Driven Engineering, Structural System Identification, Structural Dynamics, Numerical Methods, Optimization Methods, Finite Element Method Solid Mechanics, Fracture Mechanics

## POSITION OF RESPONSIBILITY

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**Joint Secretary**, Taekwondo, Institute Sports Council, IIT Roorkee

07/2016 - 05/2017

**Secretary**, Taekwondo, Institute Sports Council, IIT Roorkee

07/2017 - 05/2018

Organized and led training sessions for over 50 students, fostering discipline and teamwork, and coordinated participation in state and national-level competitions.

## HONORS AND AWARDS

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<b>Jimmie A. Schindewolf Academic Scholarship</b> by University of Houston	<i>08/2024 - 05/2025</i>
<b>Future Faculty Program</b> , University of Houston	<i>08/2024 - 05/2025</i>
<b>Presidential Fellowship</b> by University of Houston	<i>08/2023 - 05/2025</i>
<b>Finalist</b> , UQ-TTA Student Paper Competition at WCCM/PANACM, Vancouver	<i>07/2024</i>
<b>Cullen Fellowship Travel Grant</b> for EMI/PMC by University of Houston	<i>05/2024</i>
<b>Finalist</b> , Grants in Aids of Research, SIGMA-XI	<i>03/2024</i>
Secured All India Rank in the <b>top 0.35 %</b> of 1.4 million IIT-JEE candidates	<i>06/2014</i>

## EXTRA CURRICULAR

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<b>First Dan Black Belt in Taekwondo</b> by World Taekwondo Federation	<i>08/2017</i>
Represented State Uttarakhand in <b>National Taekwondo Championship</b>	<i>12/2017</i>
<b>Organiser and Instructor</b> , Self Defense Camp, Unnat Bharat Abhiyaan	<i>03/2017</i>
Led a 5-day trek, Himalayan Explorer Club, IIT Roorkee	<i>11/2016</i>
Member, National Service Scheme, IIT Roorkee	<i>07/2014 - 05/2015</i>

## ACADEMIC AND PROFESSIONAL AFFILIATIONS

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**United States Association for Computational Mechanics (USACM)**, Technical Thrust Area in Uncertainty Quantification and Probabilistic Modeling, Graduate Student Member.

**Society for Industrial and Applied Mathematics (SIAM)**, Graduate Student Member.