

RAJESH NAKKA

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Education

- Aug'18 — Jan'24 📖 **Ph.D at Indian Institute of Science, Bengaluru in Aerospace Structures**, on *Prediction of multi-physical properties of fibre-reinforced composites using deep learning*.
- Developed a universal overlap detection scheme and overlap removal by solving a constrained optimisation problem.
 - An abnormal behaviour is observed while studying the influence of fibre cross-sectional profile on the effective multi-physical properties of uni-directional composite materials.
 - Convolutional neural networks, CNN, model is developed to predict the properties of composite material that is applicable for all practical fibre volume fractions and a wide range of fibre-matrix material systems.
 - I had the opportunity to learn and use Julia, Python, gmsh, PyTorch and git extensively in this work.
- Aug'12 — Jul'14 📖 **M.Tech. at IIT Bombay in Mechanical Engg.**, (Machine Design), with a thesis on *Finite Element Simulation of Bulk Wave Propagation in Non-Linear Solids*.
- Equations governing bulk wave propagation in the infinitely long cylindrical rod are solved analytically and numerically
 - Enhancement of second harmonic amplitude is obtained analytically and numerically, using a di-chromatic input wave.
 - In this work, I have used ANSYS APDL and MATLAB tools.
- Aug'o8 — Jul'12 📖 **B.Tech at JNTUH College of Engineering, Hyderabad. in Mechanical Engg.**

Employment History

- Aug'23 – Aug'24 📖 **Overseas consultant** at Centre for Compressor Technology | City, University of London. My role involved working on *twin screw compressor rotor profile design using generative deep learning*. I developed WGAN-GP models for generating novel and valid rotor profiles of twin-screw compressors. Also, assessed their geometric and thermodynamic parameters to understand their performance in comparison to training and test profiles.
- Aug'15 – Nov'16 📖 **Assistant Professor** at Mechanical Engineering Department, Bapatla Engineering College, India. I enjoyed teaching *mechanics of materials* and *design of machine elements* for about three semesters.
- Aug'14 – July'15 📖 **PGET Post Graduate Engineer Trainee** at Mahindra Research Valley, Mahindra & Mahindra, Chennai, India.

Research Interests

- 📖 Computational solid mechanics
- 📖 Deep learning for mechanics

Research Interests (continued)

- Mechanics of heterogeneous materials
- Uncertainty quantification

Skills

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|--------------------------|--|
| Coding languages | ■ Python (4/5), Julia (4/5), L ^A T _E X (4/5), Git (4/5), ... |
| FEA softwares | ■ Abaqus, gmsb, FreeCAD, ANSYS APDL, |
| Deep learning Frameworks | ■ PyTorch, TensorFlow |
| Misc. | ■ Asymptote: The Vector Graphics Language, SCORG, |
| Languages | ■ English, Telugu and Hindi. |

Research Publications

Journal Articles

- 1 P. K. Attada, **Rajesh Nakka**, D. Harursampath, and S. A. Ponnusami, "Computational evaluation of absorption characteristics of ceramic-based auxetic materials in x-band frequencyrange," *Smart Materials and Structures*, Aug. 2023. [DOI: 10.1088/1361-665x/acf53d](#).
- 2 **Rajesh Nakka**, D. Harursampath, and S. A. Ponnusami, "A generalised deep learning-based surrogate model for homogenisation utilising material property encoding and physics-based bounds," *Scientific Reports*, vol. 13, no. 1, Jun. 2023. [DOI: 10.1038/s41598-023-34823-3](#).
- 3 **Rajesh Nakka**, A. P. Kumar, D. Harursampath, and S. A. Ponnusami, "Influence of fibre cross-section profile on the multi-physical properties of uni-directional composites," *Composite Structures*, vol. 321, p. 117 321, Oct. 2023. [DOI: 10.1016/j.compstruct.2023.117321](#).
- 4 **Rajesh Nakka**, D. Harursampath, M. Pathan, and S. A. Ponnusami, "A computationally efficient approach for generating RVEs of various inclusion/fibre shapes," *Composite Structures*, vol. 291, p. 115 560, Jul. 2022. [DOI: 10.1016/j.compstruct.2022.115560](#).

Conference Proceedings

- 1 **Rajesh Nakka**, A. P. Kumar, D. Harursampath, and S. A. Ponnusami, "Multi-physical property prediction of fibre-reinforced composites using convolutional neural networks," International Conference on Composite Materials, Belfast, 2023.

Articles Under Preparation

- 1 M. Naveen, **Rajesh Nakka**, and B. Gurumoorthy, *Inverse design of irregular periodic porous structures with controllable physical properties using generative adversarial networks*.
- 2 **Rajesh Nakka**, D. Harursampath, and S. A. Ponnusami, *High-quality RVE generation using conditional generative learning*.
- 3 **Rajesh Nakka**, S. Patil, A. Kovacevic, and S. A. Ponnusami, *Designing novel rotor profiles of twin screw compressors using generative deep learning*.

Positions of Responsibility

- **System administrator** of a high-performance computing Rocks cluster with ten computing nodes, during my PhD, from 2021-2023.

Positions of Responsibility (continued)

- **Teaching assistant** for the flight vehicle structures course at IISc, Bengaluru during the 2020 fall and 2022 fall semesters.
- **Core member** of the AERES-2023, the Aerospace Department's annual research symposium at IISc, Bengaluru.

References

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