RAJESH NAKKA

338rajesh@gmail.com 338rajesh.github.io 338rajesh 338rajesh +91-8125240324

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'08 — Jul'12 **B.Tech** at **JNTUH College of Engineering, Hyderabad.** in **Mechanical Engg.**

Employment History

Aug'23 – *Aug'24* **Post-doctoral research (overseas consultant)** at City, University of London, 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 comparision 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
- Uncertainty quantification
- Mechanics of heterogeneous materials

Skills

Coding languages	Python (4/5), Julia (4/5), LaTeX (4/5), Git (3/5), …
FEA softwares	Abaqus, gmsh, FreeCAD, ANSYS APDL,
Deep learning Frameworks	PyTorch, TensorFlow
Misc.	Asymptote: The Vector Graphics Language,
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 cluster at NMCAD lab, from 2021-2023.
- **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

Prof. Dineshkumar Harursampath
Head, NMCAD Laboratory
Department of Aerospace Engineering,
Indian Institute of Science, Bengaluru,
Karnataka, India.
mail: dineshkumar@iisc.ac.in

Dr. Sathiskumar A Ponnusami
Aeronautics and Aerospace Research Centre,
Department of Engineering,
City, University of London,
Northampton Square, London, United Kingdom.
mail: sathiskumar.ponnusami@city.ac.uk

Prof. Ahmed Kovacevic
School of Science & Technology ,
Department of Engineering,
City, University of London,
Northampton Square, London, United Kingdom.
mail: a.kovacevic@city.ac.uk

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