Deepak Kumar Pokkalla

https://deepakpokkalla.github.io/
ORCID: orcid.org/0000-0001-5339-8399

Email : deepakpokkalla@gmail.com
Phone : +1 (865) 867-2711
Google Scholar: Publications

Education

- **National University of Singapore (NUS)** — **Singapore**
  Ph.D. in Theoretical and Applied Mechanics; GPA: 4.50/5 — *Aug 2016 – Sep 2020*
  - **Accolades**: Best Student Paper Award, Engineering Mechanics Institute (EMI) Conference 2020

- **Indian Institute of Technology (BHU) Varanasi** — Varanasi, **India**
  *B.Tech. in Civil Engineering; GPA: 9.17/10 (**Department Rank 1**)* — *July 2012 – May 2016*
  - **Accolades**: IIT (BHU) Varanasi Gold Medal; CRS Iyengar Memorial Gold Medal

Work Experience

- **Postdoctoral Research Associate, Oak Ridge National Laboratory (ORNL)** — **United States**
  Mechanics & Materials, Design Optimization, Machine Learning, and Advanced Manufacturing — *Dec 2021 – Present*
  - Design and additive manufacturing of lightweight, high performance automotive parts using **topology optimization** & **machine learning** for a major automotive company.
  - Developing a novel additive manufacturing overmolding process to design **hybrid metal polymer composites** for lightweighting vehicular components for a major automotive company.
  - Performing dynamic analysis and experiments to design fiber reinforced composite **lattice structures** with enhanced energy absorption characteristics.
  - Developed a numerical model for Z-pinning **additive manufacturing** technique and performed **heat transfer** simulations to design cost efficient out of autoclave molds using large scale additive manufacturing.

- **Postdoctoral Researcher, McGill University** — **Canada**
  Design and Development of Multi-stable Mechanical Metamaterials — *Nov 2020 – Nov 2021*
  - Developing shape morphable **multistable structural systems** using theoretical, numerical (ABAQUS with Python scripts), and experimental tools for deployable space structures.

- **PhD Scholar, NUS** — **Singapore**
  Isogeometric Shape Optimization of Auxetics with Prescribed Nonlinear Deformation — *Aug 2016 – Sep 2020*
  - Developed **isogeometric analysis (IGA)** code and implemented nonlinear material models by integrating finite element analysis (FEA) with spline-based CAD design tools and validated using ABAQUS.
  - Derived and implemented a **shape (topology) optimization** framework using IGA in MATLAB to design **mechanical metamaterials** in the nonlinear regime for biomedical and stretchable electronics applications.
  - Fabricated the optimized designs via 3D Printing for stretchable strain sensors with enhanced sensitivity. Performed experimental validation using Universal Testing Machine and Digital Image Correlation (DIC).

- **Research Assistant, Ghent University** — **Belgium**
  Computational Analyses for a Fretting Fatigue Contact Problem — *May – July 2016*
  - Performed fretting fatigue stress analysis of an aluminium specimen to investigate the effect of micro-voids on stress distribution by conducting FE simulations with ABAQUS and Python scripts.
  - Modelled the macroscopic fretting fatigue contact problem using effective mechanical properties extracted from the underlying microstructure as per first-order computational homogenization technique.

- **Research Assistant, NUS** — **Singapore**
  Computational Homogenization of Heterogeneous Materials — *July – Aug 2015*

- $\circ$ Implemented first-order homogenization technique by adopting the effective mechanical properties of the microstructure at the structural level using ABAQUS with User subroutines and Python Scripts.

- **Research Assistant, IIT Gandhinagar**   **India**
  Structural Analysis and Design Intern   *May – June 2015*
  - $\circ$ Developed a 3D model of laterally supported steel chimney in CATIA and performed fluid-structure interaction analysis in ANSYS to determine the effect of wind-induced vibrations.

- **Larsen & Toubro - Chiyoda Ltd.**   **India**
  Structural Analysis and Design Intern, Mentor: Moushumi Roy, Joint GM   *May – July 2014*
  - $\circ$ Designed an industrial steel pipe rack for various loading conditions in STAAD and performed an adequacy check of pedestal and foundation using MS Excel and Mat3D.

Machine Learning Projects

- Developed and fine-tuned NLP models using state-of-the-art algorithms such as BERT, GPT-2, and XLNET to mitigate unintended bias in filtering offensive online conversations.

- Categorized e-commerce items based on their images and title descriptions using a CNN image classifier along with LSTM and GRU models.

Technical Skills

- **CAE | CAD:** STAAD, ABAQUS, ANSYS, COMSOL, LS-DYNA | Autodesk, SolidWorks, CATIA

- **Programming | Documentation:** MATLAB, Python, Fortran | LaTeX, OriginPro

- **Coursework:** Mechanics of Solids, Strength of Materials, Continuum Mechanics, Finite Element Analysis, Fracture & Fatigue of Materials, Python Data Structures, Machine Learning, Deep Learning Specialization

Awards

- Silver medal in Kaggle Data Science Competition for developing novel NLP models, 2019.

- NUS Research Scholarship for excellence in studies towards Ph.D, 2016.

- Rai Bahadur Taracharan Gue Memorial Award for excellence in studies, 2016.

- Late Prof. Manoranjan Sengupta Platinum Jubilee Merit Award for exceptional performance in B. Tech, 2016.

- Top Scorer Award in XLI National Mathematics Talent Competitions, 2009.

- Excellent Performance Award at NGC Student's Environmental Congress, 2007.

- JNV Academic Scholarship for excellence in studies towards secondary school, 2005.

Publications (*Google Scholar Citations* - **107**)

- ***In-review:*** **Pokkalla, DK.**, Wang, Z.P., Poh, L.H. and Quek, S.T., 2021. Soft missing rib auxetics with controllable negative Poisson's ratios over large strains via isogeometric design optimization.

- Zhu, Y., Jiang, S., Li, J., **Pokkalla, D.K.**, Wang, Q. and Zhang, C., 2021. Novel isotropic anti-tri-missing rib auxetics with prescribed in-plane mechanical properties over large deformations. International Journal of Applied Mechanics, 13(10), p.2150115.

- **Pokkalla, D.K.**, Poh, L.H. and Quek, S.T., 2021. Isogeometric shape optimization of missing rib auxetics with prescribed negative Poisson's ratio over large strains using genetic algorithm. International Journal of Mechanical Sciences, 193, p.106169.

- **Pokkalla, D.K.**, Wang, Z.P., Poh, L.H. and Quek, S.T., 2019. Isogeometric shape optimization of smoothed petal auxetics with prescribed nonlinear deformation. Computer Methods in Applied Mechanics and Engineering, 356, pp.16-43.

- Wang, Z.P. and **Kumar, D.**, 2017. On the numerical implementation of continuous adjoint sensitivity for transient heat conduction problems using an isogeometric approach. Structural and Multidisciplinary Optimization, 56(2), pp.487-500.

- **Pokkalla, D.K.**, Biswas, R., Poh, L.H. and Wahab, M.A., 2017. Fretting fatigue stress analysis in heterogeneous material using direct numerical simulations in solid mechanics. Tribology International, 109, pp.124-132.

- **Pokkalla, D.K.**, Aishwarya, A. and Maiti, P.R., 2016. Comparative study of dynamic analysis of rectangular liquid filled containers using codal provisions. Procedia Engineering, 144, pp.1180-1186.

- Sharma, I., **Kumar, P.D.** and Maiti, P.R., 2015. The effect of fiber orientation and laminate layup on fiber-reinforced polymer composite. IUP Journal of Structural Engineering, 8(1), p.49.

- **Kumar, P.D.**, Sharma, I. and Maiti, P.R., 2014. Parametric Study of a Simply Supported Composite Plate Using Finite Element Method. i-Manager's Journal on Civil Engineering, 4(4), p.26.

Conference Proceedings

- **Pokkalla, D.K.**, Kumar, V., Jo, E., Hassen, A.A., Cakmak, E., Alwekar, S., Kunc, V., Vaidya, U., Baid, H.K. and Kim, S., 2022, April. Anisotropic mechanical properties of polymer composites from a hybrid additive manufacturing-compression molding process using x-ray computer tomography. In Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XVI (Vol. 12047, pp. 319-328). SPIE.

- *Keynote:* Quek, S.T., **Kumar, D.** and Poh, L.H. Petal auxetics with targeted Poisson's ratios using isogeometric shape optimization. The Sixteenth East Asia-Pacific Conference on Structural Engineering & Construction, Brisbane, Australia, Dec 3-6, 2019.

- **Kumar, D.**, Wang, Z.P., Poh, L.H. and Quek, S.T. Soft network auxetic materials with prescribed mechanical properties in nonlinear regime. Advanced Materials 30 Symposium, Singapore, Dec 4, 2018.

- Biswas, R., **Kumar, D.**, and Poh, L.H. Multi-scale computational homogenization of heterogeneous material. The Twenty-Eighth KKHTCNN Symposium on Civil Engineering, Bangkok, Thailand, Nov 16-18, 2015.