

Education

- **National University of Singapore (NUS)** **Singapore**
Ph.D. in Theoretical and Applied Mechanics *Aug 2016 – Sep 2020*
 - **Accolades:** Best Student Paper Award, Engineering Mechanics Institute (EMI) Conference 2020 by ASCE
- **Indian Institute of Technology (BHU) Varanasi** **India**
B.Tech. in Civil Engineering (Department Rank 1) *July 2012 – May 2016*
 - **Accolades:** IIT (BHU) Varanasi Gold Medal; CRS Iyengar Memorial Gold Medal

Skills

- **CAE | CAD:** ABAQUS, ANSYS, LS-DYNA, STAAD, COMSOL, MCQ | SolidWorks, Autodesk, CATIA
- **Programming | Documentation:** MATLAB, Python, Git | LaTeX, Microsoft Office, Mendeley, OriginPro
- **Expertise:** Solid Mechanics, Static/Dynamic FEA, Constitutive Modeling, Multi-scale Modeling, Advanced Manufacturing (FDM, SLA, BAAM, Overmolding), Digital Image Correlation, Universal Testing Machines
- **Coursework:** Mechanics of Solids, Continuum Mechanics, Finite Element Analysis, Numerical Methods, Convex Optimization, [Python Data Structures](#), [Machine Learning](#), [Deep Learning Specialization](#), [3D Printing](#)

Work Experience

- **Postdoctoral Research Associate, Oak Ridge National Laboratory (ORNL)** **United States**
Design and advanced manufacturing of polymer composites through FEA and Machine Learning *Dec 2021 – Present*
 - Performed design optimization and additive manufacturing of lightweight, high performance composite lattices for automotive bumper through **static/dynamic FEA** in ABAQUS, **drop tower testing**, and **machine learning**.
 - Developed rapid inverse design framework for mechanical metamaterials and lattice structures with prescribed **nonlinear** mechanical response and manufacturability constraints using **deep learning**.
 - Developed FE-based simulation models for a novel **additive manufacturing - compression molding (AM-CM)** process enabling high performance composites, and hybrid metal-polymer composite structures.
 - Developed a **micromechanics**-based approach (along with **MCQ software**) to predict the mechanical properties of short fiber composites manufactured via AM, CM, and AM-CM processes, and perform FEA on various components.
 - Designed and performed FEA (ABAQUS/SolidWorks) on an automotive door armrest, overmolded metal-composites, and seat-back assembly for manufacturing through topology optimization in **Tosca** for **Ford Motor Company**.
 - Performed Process simulations on various geometries using **ABAQUS AM Modeler** for layer time optimization in large scale polymer composite additive manufacturing with experimental validation.
 - Developed FE model and performed simulations for a novel **Z-Pinning AM** Process to predict their mechanical properties and validated with experiments.
- **Postdoctoral Researcher, McGill University** **Canada**
Design of Multi-stable Mechanical Metamaterials through FEA & tensile testing with DIC *Nov 2020 – Nov 2021*
 - Developed shape morphable multi-stable structural systems using numerical modeling (**ABAQUS** with Python scripts) and experiments (tensile testing with **DIC**) for deployable space structures.
- **PhD Scholar, NUS** **Singapore**
Isogeometric Shape Optimization of Auxetics with Prescribed Nonlinear Deformation *Aug 2016 – Sep 2020*
 - Developed a **nonlinear isogeometric analysis solver** in **MATLAB** for numerous constitutive models by integrating traditional FEA with spline-based CAD design tools for **efficient CAD-CAE workflow**.
 - Developed an adjoint-based **nonlinear shape optimization** framework using nonlinear programming (SQP algorithm) for the design and 3D printing of auxetic metamaterials over large strains.
 - Implemented Genetic Algorithm (GA) from global optimization toolbox for the design of auxetic metamaterials with manufacturing constraints using Mixed-Integer Nonlinear Programming (MINLP).

- 3D Printed optimized designs to demonstrate enhanced sensitivity of stretchable strain sensors. 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*
 - 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*
 - 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*
 - 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.

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.

Journal Publications

- *In-review:* Li, J., **Pokkalla, DK.**, Wang, Y., and Wang, Z., 2023. Deep learning-enhanced design for functionally graded auxetic lattices.
- *In-review:* Seta, B., Sandberg, M., Brander, M., Mollah, Md., **Pokkalla, DK.**, Kumar, V., and Spangenberg, J., 2023. Modeling fiber orientation and strand shape morphology in three-dimensional material extrusion additive manufacturing.
- *In-review:* Kim, S., Nasirov, A., **Pokkalla, DK.**, Kishore, V., Duty, C., and Kunc, V., 2023. Compression Characteristics of Additively Manufactured Lattice Composite Structures.
- *In-review:* Nasirov, A., **Pokkalla, DK.**, Kim, S., Bales, B., Smith, T., Duty, C., and Kunc, V., 2023. Modeling the interfacial failure and resulting mechanical properties of z-pinned additively manufactured composites.
- **Pokkalla, DK.**, Hassen, A.A., Rencheck, M.L., Nandwana, P., Kunc, V., and Kim, S., 2022. A novel additive manufacturing compression molding process for hybrid metal polymer composite structures. Additive Manufacturing Letters, p.100128.

- Kumar, V., Lin, W., Wang, Y., Spencer, R., Saha, S., Park, C., Yeole, P., Hmeidat, N.S., Herring, C., Rencheck, M.L. and **Pokkalla, D.K.**, 2023. Enhanced through-thickness electrical conductivity and lightning strike damage response of interleaved vertically aligned short carbon fiber composites. *Composites Part B: Engineering*, p.110535.
- **Pokkalla, D.K. et.al.**, 2022. Soft missing rib auxetics with controllable negative Poisson's ratios over large strains via isogeometric design optimization, *Journal of Engineering Mechanics*.
- **Pokkalla, D.K. et.al.**, 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. et.al.**, 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. et.al.**, 2019. Isogeometric shape optimization of smoothed petal auxetics with prescribed nonlinear deformation. *Computer Methods in Applied Mechanics and Engineering*, 356, pp.16-43.
- **Pokkalla, D.K. et.al.**, 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. et.al.**, 2017. Fretting fatigue stress analysis in heterogeneous material using direct numerical simulations in solid mechanics. *Tribology International*, 109, pp.124-132.
- **Pokkalla, D.K. et.al.**, 2016. Comparative Study of Dynamic Effect on Analysis Approaches for Circular Tanks Using Codal Provisions. *International Journal of Civil and Environmental Engineering*, 9(3), pp.365-372.
- **Pokkalla, D.K. et.al.**, 2016. Comparative study of dynamic analysis of rectangular liquid filled containers using codal provisions. *Procedia Engineering*, 144, pp.1180-1186.
- Sharma, I., **Pokkalla, D.K.** 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.
- **Pokkalla, D.K. et.al.**, 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.**, Hassen, A.A., Heineman, J., Snape, T., Arimond, J., Kunc, V., and Kim, S. Thermal Analysis and Design of Self-heating Molds using Large-Scale Additive Manufacturing for Out-of-Autoclave Applications. In *ASME International Mechanical Engineering Congress and Exposition*.
- Berin, S., Mollah, Md. T., Kumar, V., **Pokkalla, D.K.**, Kim, S., Hassen, A.A., and Spangenberg, J., 2022. Modelling fiber orientation during additive manufacturing-compression molding processes. In *2022 Solid Freeform Fabrication Symposium*. University of Texas at Austin.
- Bales, B., Walker, R., **Pokkalla, D.K.**, Kim, S., Kunc, V., and Duty, C., 2022. Design and Use of a Penetrating Nozzle for Z-Pinning Additive Manufacturing. In *2022 Solid Freeform Fabrication Symposium*.
- Berin, S., Mollah, Md. T., Kumar, V., **Pokkalla, D.K.**, Kim, S., and Spangenberg, J., 2022. Modelling of additive manufacturing - compression molding process using computational fluid dynamics, *American Society for Precision Engineering Conference*.
- Jo, E., Liu, L., Ju, F., Hoskins, D., **Pokkalla, D.K.**, Kunc, V., Vaidya, U. and Kim, P., 2022. The design of **layer time optimization** in large scale additive manufacturing with fiber reinforced polymer composites. *SAMPE 2022 Conference and Exhibition*.
- **Keynote:** Quek, S.T., **Pokkalla, D.K.** 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.
- **Pokkalla, D.K.**, 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., **Pokkalla, D.K.**, 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.

References

- **Prof. Quek Ser Tong** Professor, NUS ceeqst@nus.edu.sg
- **Prof. Poh Leong Hien** Associate Professor, NUS ceeph@nus.edu.sg
- **Dr. Zhen-pei Wang** Scientist, A-STAR wang-zhenpei@ihpc.a-star.edu.sg