Sourabh Shende

513-432-8327 | shendesc@mail.uc.edu | sourabh-shende.github.io | LinkedIn

Skills

Finite Element Analysis	Abaqus, Altair, Ansys
Machine Learning Frameworks	PyTorch, TensorFlow
High Performance Computing	SLURM, LSF, MPI, OpenMP
Programming	MATLAB, Python, Tcl, VBA, Fortran, C++, LaTeX
Version Control	Git

Work Experience

University of Cincinnati
Cincinnati, Ohio, USA

GRADUATE RESEARCHER
Apr. 2018 - Present

- Developed Bayesian optimization (BO) technique using Gaussian process (GP) surrogate for efficiently discovering origami-inspired folding structures. Demonstrated its superiority over gradient-based and genetic algorithms with an order of magnitude fewer function evaluations.
- Enhanced vanilla BO with gradient and anisotropy information. These enrichments showcased a threefold increase in speed for uncovering optimal designs.
- Applied anisotropy enriched Bayesian optimization (BO) for material calibration of hyperelastic Yeoh model for porcine meniscus.
- Developed energy-based machine learning framework, deep energy minimization (DEM), using neural network surrogate to solve deformations of hyperelastic multistable structures. Demonstrated advantages and shortcomings of DEM over well-established finite element approaches.
- Developed machine learning framework, deep energy minimization (DEM), to solve phase-field plasticity problems (mesoscale) without volumetric locking. Characterized unique plasticity parameters of the phase-field model using DEM machine learning framework.

P&G Digital Accelerator
Cincinnati, Ohio, USA

GRADUATE RESEARCH ASSISTANT
Jan. 2019 - Present

- Developed a detailed finite element model of non-woven paper at the fiber scale level (microscale) using connectors elements representing glue.
- Developed performance tests: Tensile, Compression, and Bending to determine the strength of non-woven paper by defining damage mechanics to the connector elements.
- Developed automation scripts to speed up the setup and launch time of the simulations.
- Developed detailed finite element model for corrugated cases used for packaging.
- Automated detailed finite element pre-processing of a corrugated case using *tcl* script in Altair Hypermesh.
- Performed top load simulations on different designs of plastic tubs used for storing liquid pods.

Altair Engineering
Troy, Michigan, USA

SOFTWARE INTEGRITY INTERN
May 2018 - Aug. 2018

- Designed and developed multiple *tcl* automation scripts to test the functionality and performance of Altair HyperMesh's newly developed features.
- Analyzed and validated the scripts by comparing the script's output to the intended output.

Bajaj Auto Limited
Pune, Maharashtra, India

SENIOR CAE ENGINEER
Jul. 2015 - Jun. 2017

- Developed and validated Finite Element (FE) modeling methodology for welded components.
- Performed durability simulations and suggested design changes for exhaust system (silencer), cylinder head, crankcase, connecting rod and crankshaft for improving fatigue life.
- Improved modal assurance criteria (MAC) correlation methodology used for Finite Element model validation.
- Established welding standard to decide pass/fail criteria for exhaust system (silencers). Standard was developed by measuring parameters like weld leg lengths, weld penetration, root gap, grain size, extend of HAZ and hardness of the road endurance passed silencers.
- Developed automation scripts in Excel VBA and *tcl* to drastically reduce Finite Element model setup time.

Education

University of Cincinnati
Cincinnati, US

Doctor of Philosophy, Mechanical Engineering, $4.0/4.0$
2020 - Present

- Dissertation: *Scientific machine learning approaches for nonlinear computational mechanics*
  Advisor: Dr. Kumar Vemaganti

University of Cincinnati
Cincinnati, US

Master of Science, Mechanical Engineering, $4.0/4.0$
2017 - 2020

- Thesis: *Bayesian topology optimization for efficient design of origami folding structures*
  Advisor: Dr. Kumar Vemaganti

Visvesvaraya National Institute of Technology *Nagpur, India*

Bachelor of Technology, Mechanical Engineering, $9.03/10.0$ *2011 - 2015*

- Thesis: *Design and development of low-cost silicone implant used in augmentation rhinoplasty suitable for the Indian sub-continental population*
  Advisor: Dr. Rashmi Uddanwadiker

Publications & Conferences

- **Shende, S.**, and Vemaganti K. "*Application of energy-based physics informed machine learning for multistable beam structure,*", European Journal of Mechanics - A/Solids (in review).
- **Shende, S.**, and Vemaganti K."*Application of physics informed machine learning for buckling of bi-stable beam structure,*", 17th U.S. National Congress on Computational Mechanics, Albuquerque, New Mexico, July 23-27, 2021.
- Long, T., **Shende, S.**, Lin C., and Vemaganti K. "*Experiments and hyperelastic modeling of porcine meniscus show heterogeneity at high strains*", Biomechanics and Modeling in Mechanobiology, (2022).
- **Shende, S.**, Gillman A., Buskohl P., and Vemaganti K. "*Systematic cost analysis of gradient- and anisotropy-enhanced Bayesian design optimization*", Structural and Multidisciplinary Optimization, Vol. 65, Issue. 8 (2022): 235-262.
- **Shende, S.**, and Vemaganti K."*Bayesian topology optimization for efficient design of origami folding structures*", 16th U.S. National Congress on Computational Mechanics July 25-29, 2021.
- **Shende, S.**, Gillman A., Yoo D., Buskohl P., and Vemaganti K. "*Bayesian Topology Optimization for Efficient Design of Origami Folding Structures*", Structural and Multidisciplinary Optimization, Vol. 63, Issue. 4 (2021): 1907-1926.
- Inamdar, A., Adhe, N., **Shende, S.**, et al, "*Design and development of low cost silicone implant used in augmentation rhinoplasty suitable for the indian sub-continental population*", International Journal of Pharma Medicine and Biological Sciences, Vol. 5, Issue. 1 (2016): 81-85.

Selected Projects

- **Non-linear Hyper-elastic response:**
  - Developed MATLAB script to determine nonlinear force response of hyper-elastic materials with *Ogden* and *Gent* strain energy potentials when subjected to uni-axial, bi-axial, and pure shear deformation modes.
  - Implemented the *Newton-Raphson* method to solve the nonlinear equations iteratively.
- **Parallelization of Linear iterative solver:**
  - Developed a Fortran code to solve 2D Poissons problem using conjugate gradient linear iterative solver.
  - Used Message Passing Interface (MPI) for parallelization of the solver with 1D and 2D decomposition of the domain.
- **Non-linear Bending of thin Beam:**
  - Developed a script to solve the non-linear bending of the thin beam when subjected to a large moment value at its ends.
  - Implemented the modified Newton-Raphson method with the total Lagrangian configuration scheme under plane strain conditions for convergence between each load step.
- **Multi-Layer Feed-Forward Neural Network:**
  - Developed Python script for the multi-layer feed-forward neural network from scratch for classification of the digit images from MNIST dataset.
  - Implemented the backpropagation algorithm for the training of the neural networks.
- **Finite Element formulation:**
  - Developed MATLAB code to formulate 2D *tria3* and *quad4* elements to solve linear static problem.
  - Validated the accuracy of the developed scripts by comparing the solution with those generated by a commercial Finite Element software package.
- **Modal Parameter Estimation (MPE) and Finite Element validation:**
  - Extracted modal parameters of Circular (aluminum) and Rectangular (steel) plate using X-modal III software from captured Frequency Response Functions (FRFs).
  - Correlated modal frequencies and mode shapes with corresponding finite element models.