Sandeep Reddy Bukka

Scientist @LRST-NETL
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Personal Homepage

Computational scientist with over 8+ years of research and work experience spanning three continents at world class research laboratories. Extensive expertise in data-driven computational methods/A.I. models for physical systems. It is my strong desire to build on this experience and create cutting-edge solutions at the intersection of data-driven science and traditional physics-based methods.

Technical Interests

Machine Learning • Deep Learning • Physics informed A.I • Model Order Reduction • Computational Physics • Nonlinear Dynamics •

Research and Work Experience

01/2023- **Research Scientist** , *Leidos Research Support Team (LRST)*, NETL, Pittsburgh.
Intelligent Sensing of Natural Gas Pipelines
1. Supporting Leidos in executing a mulit-year and multi-million dollar research service support (RSS) contract with Department of Energy (DOE) at National Energy Technology Laboratory (NETL), pittsburgh
2. This project carries a lot of national significance because it directly enables DOE to address the Nation's energy challenges via innovative technological solutions, which will be developed at NETL as part of this contract
3. Part of a big collaborative team with people from diverse backgrounds and experiences.
4. Technical lead and PoC for the development of digital twin of natural gas pipeline and directly responsible or all the efforts on combining A.I. with numerical simulations.

09/2021- **Postdoctoral Researcher**, *Max Planck Institute*, Magdeburg.
09/2022 ***Physics Enhanced Machine Learning***
1. Responsible for a collaborative project with Max Planck Institute for Iron research under BiGmax
2. Proposal and execution of a research plan to use Physics informed A.I. to discover physically interpretable continuum models of materials science from experimental data
3. Conduct fundamental research on modelling of nonlinear dynamical systems using scientific machine learning

03/2020- **Scientist I**, *TCOMS*, Singapore.
09/2021 ***Development of digital twin of ocean wave environment***
Lead at TCOMS for the efforts on reduced order approaches and data-driven modelling of nonlinear ocean waves. The following tasks were accomplished.
1. Reconstruction of ocean wave field from instantaneous probe data using compressed sensing
2. Reduced order models for fast propagation of multi-directional ocean wave fields
3. Fourier Neural Operators for reconstruction and propagation of multi-directional ocean wave fields

08/2015- **Research Scholar/ Research Engineer**, *National University of Singapore*, Singapore.
03/2020 ***Data-driven computing for stability analysis and prediction of fluid-structure interaction***
1. Data-driven computing for stability analysis of passive suppression
2. Hybrid reduced order model for fluid structure interaction
3. Convolutional recurrent autoencoder networks for complete prediction of flow field

Education

03/08/2015– **PhD, Computational Fluid Dynamics**, *National University of Singapore*, Singapore.
28/02/2020 GPA: 4.33/5.0
Advisors: Prof. Allan Ross Magee, Prof. Rajeev K Jaiman

02/08/2010–24/07/2015 **B.Tech & M.tech (Dual Degree), Ocean Engineering and Applied Mechanics**, *Indian Institute of Technology, Madras*, India.
GPA: 8.21/10
Advisors: Prof. K Murali, Prof. S Vengadesan

Research Contributions

Journal Articles

2023 Abhishek Venketeswaran, Nageswara Lalam, Ping Lu, Sandeep R Bukka, Michael P Buric, and Ruishu Wright. Robust vector botda signal processing with probabilistic machine learning. *Sensors*, volume 23, page 6064. MDPI, 2023.

2021 Sandeep Reddy Bukka, Yun Zhi Law, Harrif Santo, and Eng Soon Chan. Reduced order model for nonlinear multi-directional ocean wave propagation. *Physics of Fluids*, volume 33, page 117115. AIP Publishing LLC, 2021.

2021 Sandeep Reddy Bukka, Rachit Gupta, Allan Ross Magee, and Rajeev Kumar Jaiman. Assessment of unsteady flow predictions using hybrid deep learning based reduced-order models. *Physics of Fluids*, volume 33, page 013601. AIP Publishing LLC, 2021.

2020 SR Bukka, AR Magee, and RK Jaiman. Stability analysis of passive suppression for vortex-induced vibration. *Journal of Fluid Mechanics*, volume 886. Cambridge University Press, 2020.

In Conference Proceedings

2023 Pengdi Zhang, Abhishek Venketeswaran, Sandeep R Bukka, Enrico Sarcinelli, Nageswara Lalam, Ruishu F Wright, and Paul R Ohodnicki. Machine learning data analytics based on distributed fiber sensors for pipeline feature detection. In *Optical Waveguide and Laser Sensors II*, volume 12532, pages 49–60. SPIE, 2023.

2020 Rachit Gupta, Sandeep Reddy Bukka, and Rajeev Jaiman. Assessment of hybrid data-driven models to predict unsteady flows. In *APS Division of Fluid Dynamics Meeting Abstracts*, pages K09–017, 2020.

2020 Sandeep R Bukka, Allan Ross Magee, and Rajeev K Jaiman. Deep convolutional recurrent autoencoders for flow field prediction. In *International Conference on Offshore Mechanics and Arctic Engineering*, volume 84409, page V008T08A005. American Society of Mechanical Engineers, 2020.

2019 Sandeep B Reddy, Allan Ross Magee, Rajeev K Jaiman, J Liu, W Xu, A Choudhary, and AA Hussain. Reduced order model for unsteady fluid flows via recurrent neural networks. In *International Conference on Offshore Mechanics and Arctic Engineering*, volume 58776, page V002T08A007. American Society of Mechanical Engineers, 2019.

2018 Sandeep B Reddy, Allan Ross Magee, and Rajeev K Jaiman. A data-driven approach for the stability analysis of vortex-induced vibration. In *International Conference on Offshore Mechanics and Arctic Engineering*, volume 51210, page V002T08A004. American Society of Mechanical Engineers, 2018.

Talks

2022 **BiGmax workshop 2022**, *Bochum, Germany*, April 11-13.
Physics enhanced machine learning for discovery of phase field models

2018 **WCCM 2018**, *Newyork, USA*, July 22-27.
A Data-driven approach for stability and forecast of fluid-structure interaction systems

Activities

2022 **MS Co-organizer @USNC/TAM 2022**, *Austin, USA*, June 19-24.
Physics-Based Simulation & Machine Learning Fusion for Sensor Network Design, Optimization, and Digital Twin Applications

Fellowships & Awards

2015-2020 **NUS Research Scholarship**, *National University of Singapore.*

2019 **OMAE Outreach Travel Grant** .

2014-2015 **Graduate Teaching Assistantship**, *IIT Madras.*

Computer skills

Programming Languages: Python, Julia, Fortran, Matlab

ML frameworks: Tensorflow, Pytorch

Teaching Assistantship

2019 **CE3155: Structural Analysis**, NUS, Singapore.

2018 **CE1101: Civil Engineering Principles and Practice**, NUS, Singapore.

Student Leadership

2018-2019 **Resident assistant @ Utown residence**, NUS, Singapore.

2014-2015 **Hospitality Lead @ Saarang 2015**, IIT Madras.