# Rahul Halder, PhD

**Post-Doctoral Researcher**
**Mathematics Department, International School for Advanced Studies, Trieste, Italy**
**E-mail1: rahulhalderju.official@gmail.com**
**E-mail2: rhalder@sissa.it**

## Research Interests

Fluid-Structure Interaction, Reduced Order Model, Scientific ML, Aeroelasticity, Computational Fluid Dynamics.

## Work Experinece

2022 - Present: Post-Doc Researcher, Mathematics Department, International School for Advanced Studies, Italy

2021 - 2022: Post-Doc Researcher, Aerospace Engineering Department, University of Michigan, Ann Arbor, USA

2020 - 2021: Research Scientist, Temasek Laboratory, Singapore

## Education

2015 - 2020: PhD, Department of Mechanical Engineering, National University of Singapore, Singapore.

2013 - 2015: Master of Technology, Department of Mechanical Engineering, Thermal Engineering, Indian Institute of Technology, Madras, Chennai, India. CPI - 9.25/10.

2009 - 2013: Bachelor of Engineering, Department of Mechanical Engineering, Jadavpur University, Kolkata, West Bengal, India. CPI - 8.68/10.

## Research Topics

### Postdoctoral Research (September 2022- Present): "Reduced Order Model and Scientific Machine Learning in SISSA, Italy with **Prof. Gianluigi Rozza**"

*Development of Non-Intrusive Data-Driven ROM for **Industrial Applications**. *Discretized Governing Equation-Based Physics Informed Neural Network. *Regularized Galerkin Reduced Order Model for Quasi-Geotropic Equation for **Oceanographic Problems**.

Postdoctoral Research (August 2021- August 2022): "Linearized Reduced Order Model for High Aspect Ratio Wing in University of Michigan, USA with **Prof. Carlos Cesnik**"

*Development of ML-based Linearized strain-based nonlinear structural model. * **High Aspect Ratio Wing Aeroelasticity**. *Development of UM/NAST solver at the University of Michigan.

Research Scientist (April 2020- August 2021): "Reduced Order Model for Wave-Structure Interaction", PI of Project: **Prof. Khoo Boo Cheong**

*Smooth Particle Hydrodynamics for **Wave-Structure Interaction**. *Physics Informed Neural Network.

PhD Thesis (July 2015-March 2021): "Discrete Empirical Interpolation Method Augmented Non-Instrusive Reduced Order Model for Aeroelastic Instabilities and Gust Load Analysis" under **Prof. Khoo Boo Cheong**

*Development of linear and non-linear Non-Intrusive Reduced Order Model for the **aeroelastic instabilities and Gust-Load Analysis** *Aeroelastic instabilities under Periodic Gust Loads at Viscous Transonic Regime *Opensource Finite Volume Compressible flow solver SU2.

Masters Thesis (July 2014-July 2015): "Droplet generation in a microchannel with a controllable deformable wall " under **Prof. Ashish Kumar Sen**

*Flexible Micro-channel *Fluid-Structure Interaction ***Biomedical Application**

## Journal Publications

1. Raj A., **Halder R.**, Parayil S., Sen A. K., *"Droplet generation in a microchannel with a controllable deformable wall"*. Microfluidics and Nanofluidics, 20(7), pp.20:102, June 2016. `https://link.springer.com/article/10.1007/s10404-016-1768-4`
2. **Halder R.**, Damodaran M. and Khoo B.C., *"A Signal Interpolation Approach Augmented Linear Non-Intrusive Reduced Order Model for Aeroelastic Applications"*. AIAA Journal, 58(1), pp.426-444, Jan 2020. `https://arc.aiaa.org/doi/abs/10.2514/1.J058529`
3. **Halder R.**, Damodaran M. and Khoo B.C., *"A Deep-Learning Based Nonlinear Reduced Order Model for Airfoil Gust and Aileron Buzz Response"*. AIAA Journal 58(10), pp. 4301-4321, October 2020. `https://arc.aiaa.org/doi/abs/10.2514/1.J059027`
4. **Halder R.**, Damodaran M. and Khoo B.C., *"Computational Assessment of Transonic Airfoil-Gust Aeroelastic Response"*. AIAA Journal 60(4), pp. 2597-2614, January 2022. `https://arc.aiaa.org/doi/abs/10.2514/1.J060344`
5. **Halder R.**, Damodaran M. and Khoo B.C., *"Deep learning-driven nonlinear reduced-order models for predicting wave-structure interaction"*. Ocean Engineering, 280:114511, April 2023. `https://doi.org/10.1016/j.oceaneng.2023.114511`

## Conferences

1. **Halder R.**, Hajisharifi A., Girfoglio M., Stabile G., Rozza G., *"A Deep-Learning Enhanced Gappy-POD Method: Application in an Industrial Conjugate Heat Transfer Problem"*., presented in M2P 2023, Taormina, Sicily, 30th May-1st June 2023.

2. **Halder R.**, Stabile G., Rozza G., *"Discretized PDE-based Physics Informed Neural Network: Application in Fluid-Structure Interaction Problem"*., presented in Coupled 2023, Crete, Greece, 5th -7th June 2023.
3. Tay W.B., Damodaran M., The Z.D. and **Halder R.**, *"Investigation of Applying Physics Informed Neural Networks (PINN) and Variants on 2D Aerodynamics Problems"*. Presented in ASME 2020 Fluids Engineering Division Summer Meeting, July 13-15, 2020, Virtual Conference, FEDSM2020-20184, V003T05A055. https://doi.org/10.1115/FEDSM2020-20184
4. **Halder R.**, Damodaran M. and Khoo B.C., *"Implementation of a Modal Analysis Platform for Aeroelastic Computation in an Open Source CFD Solver SU2 and Application in Reduced Order Modelling"*. Presented in Virtual SU2 Conference 2020, June 10-12, 2020.
5. **Halder R.**, Damodaran M. and Khoo B.C., *"Transonic Flutter Prediction Using Subspace Identification Based Reduced Order Method with Parametric Variation and Flowfield Reconstruction"*. AIAA Aviation conference 2019, Texas, Dallas, 17-21 June 2019. https://arc.aiaa.org/doi/abs/10.2514/6.2019-3390

## Teaching Experience

| | |
|---|---|
| Fluid Mechanics: | Teaching Assistant in Bachelor Level Course and Laboratory at National University of Singapore. |
| Machine Design: | Teaching Assistant in Bachelor Level Laboratory at National University of Singapore. |
| Fluid Mechanics: | Instructor in Evening Classes of Bachelor Level Course at National University of Singapore. |

## Reviewer of Journal(s) and Conference Proceeding(s)

AIAA Journal, Proceedings in Applied Mathematics and Mechanics, Physics of Fluid, Ocean Engineering Journal.

## Profiles

| | |
|---|---|
| Google Scolar | https://scholar.google.com.sg/citations?user=uIe-AjkAAAAJ&hl=en |
| ResearchGate | https://www.researchgate.net/profile/Rahul-Halder |

## References

### Prof.Khoo Boo Cheong (PhD advisor)

Professor of Mechanical Engineering and Director Temasek Laboratories, National University of Singapore.

Email id: **mpekbc@nus.edu.sg**

Webpage: https://cde.nus.edu.sg/me/staff/khoo-boo-cheong-2/

### Dr.Murali Damodaran (PhD co-advisor)

Adjunct Senior Research Scientist, Temasek Laboratories, National University of Singapore, Singapore and Visiting Professor, Dept. of Aerospace Engineering, IIT Kanpur, India

Email id: **tslmura@nus.edu.sg**

Webpage: https://temasek-labs.nus.edu.sg/program/program_aerodynamics_tslmura.html

### Prof.Gianluigi Rozza (PostDoc mentor)

Full Professor in Numerical Analysis and Scientific Computing (SSD MAT/08, A1/05) at SISSA mathLab, Mathematics Area, SISSA – International School for Advanced Studies, Trieste, Italy.

Email id: **grozza@sissa.it**

Webpage: `https://mathlab.sissa.it`

### Dr.Giovanni Stabile (Collaborator)

Assistant Professor (RTD-B) at the University of Urbino "Carlo Bo", Department of Pure and Applied Sciences, Informatics, Italy.

Email id: **giovanni.stabile@uniurb.it**

Webpage: `https://www.giovannistabile.com/`