

# Nirmal Jayaprasad Nair

---

<b>Contact Information</b>	University of Illinois at Urbana-Champaign Department of Aerospace Engineering Talbot Laboratory Urbana, Illinois 61801	website: nirmaljp6.com phone: 217-305-1356 email: njn2@illinois.edu
<b>Education</b>	<b>University of Illinois at Urbana-Champaign</b> , Urbana, Illinois Ph.D., Aerospace Engineering Concentration: Computational Science and Engineering	2018 – present GPA: 3.96/4.0
	<b>University of Illinois at Urbana-Champaign</b> , Urbana, Illinois M.S., Aerospace Engineering	2016 – 2018 GPA: 4.0/4.0
	<b>Indian Institute of Technology Gandhinagar</b> , Gujarat, India B.Tech. ( <i>Honors</i> ), Mechanical Engineering	2012 – 2016 GPA: 9.24/10.0
<b>Research Interests</b>	<ul style="list-style-type: none"><li>• Computational fluid dynamics</li><li>• Fluid-structure interaction</li><li>• High performance computing</li><li>• Deep learning</li><li>• Reduced-order modeling</li><li>• Machine learning</li></ul>	
<b>Research Experience</b>	<p><b>Graduate Research Assistant</b> September 2018 – present Ph.D. thesis adviser: Prof. Andres Goza, UIUC, Champaign, IL Integrating sensor data into reduced-order models (ROMs) using deep learning.</p> <ul style="list-style-type: none"><li>• Developing a state estimation methodology where real-time sensor data is mapped to the ROM state space using deep neural networks in Pytorch.</li></ul> <p>Data-driven flow field estimation around an airfoil using passively deployed flaps.</p> <ul style="list-style-type: none"><li>• Passively deployed flaps will be modeled as flow-field estimating sensors by mapping the dynamics of the flaps to the flow-field using snapshot data.</li></ul> <p>Scalable solver for simulating strongly coupled fluid-interaction flows.</p> <ul style="list-style-type: none"><li>• Developing a parallel CFD solver for simulating fluid-structure interaction problems consisting of rigid and torsionally hinged bodies using MPI and PETSC.</li></ul> <p><b>CSRI Summer Intern</b> June 2019 – August 2019 Adviser: Dr. Kevin Carlberg, Sandia National Laboratories, Livermore, CA Guaranteeing convergence of ROMs on nonlinear manifold using transfer learning.</p> <ul style="list-style-type: none"><li>• Developed an adaptive manifold refinement strategy to enable convergence of ROMs on manifolds built using deep convolutional autoencoders on Tensorflow.</li></ul> <p><b>Graduate Research Assistant</b> August 2016 – August 2018 M.S. thesis adviser: Prof. Maciej Balajewicz, UIUC, Champaign, IL Data-driven reduced-order modeling of advection-dominated fluid flows.</p> <ul style="list-style-type: none"><li>• Developed a novel data-driven model order reduction method for parametric, steady-state fluid flows containing evolving shocks.</li></ul> <p><b>Summer Undergraduate Research Fellow</b> May – July 2015 Adviser: Prof. Austin Minnich, California Institute of Technology, Pasadena, CA</p> <ul style="list-style-type: none"><li>• Designed and fabricated a prototype consisting of thermoelectric generators to power wireless temperature sensors in aircraft.</li></ul>	

**Summer Research Internship Program**

May 2014 – April 2015

Adviser: Prof. Vinod Narayanan, IIT Gandhinagar, India

- Studied the stability characteristics of axisymmetric thermal boundary layer of various fluids in response to heating and cooling.

**Skills**

Programming: Python, Matlab, Fortran, C.

Machine Learning: Pytorch, Tensorflow.

High Performance Computing: PETSC, MPI, OpenMP.

CFD and CAD: Ansys Fluent, Star CCM+, Autodesk Inventor.

Miscellaneous: Latex, Git.

**Publications**

1. N.J. Nair and A. Goza. Leveraging reduced-order models for state estimation using deep learning. *Journal of Fluid Mechanics*, 2020.
2. N.J. Nair and M. Balajewicz. Transported snapshot model order reduction approach for parametric, steady-state fluid flows containing parameter-dependent shocks. *International Journal for Numerical Methods in Engineering*, 2019; 117:12341262.
3. N. Jayaprasad, et al. Exploring viscous damping in undergraduate Physics laboratory using electromagnetically coupled oscillators. *Preprint arXiv:1311.7489*, 2013.

**Conference Talks****Invited Talks**

1. N.J. Nair and M. Balajewicz. Transported snapshot model order reduction approach for parametric, steady-state fluid flows containing parameter dependent shocks. *SIAM Conference on Computational Science and Engineering*, 2019.

**Contributed Talks**

1. N.J. Nair and A. Goza. Integrating sensor data into reduced-order models with deep learning. *APS, Division of Fluid Dynamics*, 2019.
2. N.J. Nair and M. Balajewicz. Physics based interpolation for steady parametric partial differential equations. *APS, Division of Fluid Dynamics*, 2017.
3. N.J. Nair and U. Shah. A simple computational tool for studying acoustic waves in nonlinear medium. *ASME, International Design Engineering Technical Conferences*, 2017.
4. N. Jayaprasad and V. Narayanan. Effect of viscosity stratification on stability of axisymmetric boundary layer. *APS, Division of Fluid Dynamics*, 2015.

**Honors & Awards**

AE Outstanding Graduate Student Fellowship, UIUC	2020
Conference Travel Grant, APS DFD	2019
SIAM Student Travel Award, SIAM CSE	2019
Conference Travel Award for Graduate Students, UIUC	2017
MSNDC Student Travel Grant, ASME IDETC	2017
Award for ‘Best Performance in the core subjects of Engineering Graphics, Manufacturing and Workshop Practice’, IIT Gandhinagar	2016
Summer Undergraduate Research Fellowship, Caltech	2015
Dean’s List, IIT Gandhinagar	2013, 2014, 2015
Merit cum Means Scholarship, IIT Gandhinagar	2012, 2013, 2014
Winner of Ricoh Printer Design Challenge, IIT Gandhinagar	2014

<b>Projects</b>	<b>Nonlinear modal decomposition of transient fluid flows</b> , UIUC      Spring 2020 <ul style="list-style-type: none"> <li>Developed a nonlinear modal decomposition framework to accurately represent transient fluid flows and extract meaningful flow structures using deep convolution autoencoders.</li> </ul>
	<b>MPI and OpenMP based parallel 2D CFD solver</b> , UIUC      Fall 2018 <ul style="list-style-type: none"> <li>Developed a parallel solver based on finite difference methods to solve the 2D advection-diffusion equation using MPI and OpenMP.</li> </ul>
	<b>Passive flow control using vortex generators</b> , UIUC      Fall 2016 <ul style="list-style-type: none"> <li>Studied passive flow control using vortex generators to delay shock induced flow separation on an Onera M6 wing in transonic flow regime using Ansys Fluent.</li> </ul>
<b>Academic Services and Affiliations</b>	Reviewer, Journal of Computational Physics      2018–
	Reviewer, International Journal for Numerical Methods in Engineering      2018–
	Student Member, Society of Industrial and Applied Mathematicians (SIAM)      2018 –
	Student Member, American Physical Society (APS)      2017 –
<b>Teaching</b>	<b>Teaching Assistant</b> , UIUC      September – December 2019 AE 433: Aerospace Propulsion
	<b>Tutor</b> , IIT Gandhinagar      January – March 2016 ES 212: Momentum, Heat and Mass Transfer
	<b>Teaching Assistant</b> , IIT Gandhinagar      August – November 2013 ES 101: Engineering Graphics
<b>Leadership</b>	<b>Mentor</b> , Summer Undergraduate Research, UIUC      May – July 2017 Mentored and supervised an undergraduate student on his research project and provided the necessary guidance to maintain progress.
	<b>Events Coordinator</b> , Amalthea' 13, IIT Gandhinagar      May – October 2013 Led a team of 21 students to plan and organize various technical events at Amalthea'13 which is the annual technical summit of IIT Gandhinagar.