ADITYA SAINI

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EDUCATION

- **Ph.D., Aerospace Engineering**   2014 – Present   GPA: 3.897/4
  North Carolina State University (Raleigh, NC)

- **Master of Science, Aerospace Engineering**   2012 – 2014   GPA: 3.87/4
  North Carolina State University (Raleigh, NC)

- **Bachelor of Technology, Mechanical Engineering**   2008 – 2012   GPA: 7.94/10
  Indian Institute of Technology (Ropar, Punjab)

Relevant coursework: Applied Aerodynamics, Experimental Fluid mechanics, Computational Fluid dynamics, Advanced Dynamics, Airfoil and Wing Theory, Engineering Design Optimization, Design of Smart Material Systems, Propulsion Systems, Energy Science and Technology, Power Plant Engineering, Fluid dynamics of combustion, Heat and Mass Transfer, Strength of Materials, Manufacturing processes, Controls and Vibration.

PROJECT EXPERIENCE

Leading-Edge Flow Sensing Algorithm   North Carolina State University

- Developed a novel algorithm for predicting the aerodynamic operating state variables such as angle of attack, airspeed, stagnation-point location, and local lift coefficient on wing/rotor blade sections using a few leading-edge pressure measurements.
- Demonstrated the functioning of the LEFS algorithm on wind tunnel data for steady flow and rotating blade data obtained from test campaigns conducted by NREL. Conducted wind tunnel tests to assess the effectiveness of the method in deducing the loss of dynamic pressure at the tail surface due to wake impingement.
- Successfully applied the LEFS algorithm for detecting surface signatures associated with leading-edge vortex shedding and detachment from airfoils undergoing unsteady motions.

Aerodynamic Flow Sensing with Elastic Microfence Structures   North Carolina State University

- Conducted wind tunnel testing of shear stress sensors, fabricated in collaboration with NASA Langley Research Center. Designed and fabricated a flat-plate experimental setup to characterize the sensor elements under real flow conditions in a wind tunnel.
- Developed MATLAB codes for image enhancement and stabilization using image processing toolbox for post-processing to eliminate the effects of flow-induced vibration in the recorded data.
- Evaluated the response of the microfence structures under different freestream velocities.
- Designed experiments and conducted tests to characterize the directional sensitivity of the microstructures by creating flow reversal at the sensor location.

Advanced Dynamics Simulations   North Carolina State University

- Modeled and simulated the multi-body motion of a gyroscopic system using Newton-Euler approach.
- Animated the system for comparison with the real experimental setup to analyze the phenomenon of precession and nutation.
- Derived the equations of motion for a conceptual lighter-than-air airborne wind turbine system and investigated the feasibility of the concept by modeling the dynamics based on real external conditions.

Development of CFD solvers   North Carolina State University

- Developed CFD codes for solution of Incompressible Navier-Stokes Equations using Finite Volume Methods for a driven cavity and for flow in a divergent channel (with and without an immersed body) using MATLAB.
- Solved 2D Euler compressible equations using Discrete Galerkin method and multi stage Runge Kutta time marching scheme for subsonic, supersonic and transonic flow past arbitrary bodies using FORTRAN.
- Used Finite element method for numerically solving potential flow equations in FORTRAN.

Wing Aerodynamics   North Carolina State University

- Created codes based on the lifting line theory and Vortex Lattice method for the analysis of different types of subsonic wing configurations.
- Designed a cambered low-speed natural-laminar-flow airfoil using PROFOIL for given design objectives for a general-aviation airplane.
- Developed a code for implementing genetic-algorithm for the design of an airfoil for a low-drag fairing.

Inverse Kinematics of a planar serial manipulator with N – LINKS   **IIT Ropar**

- Formulated a geometrical method for the transformation of the position of a manipulator end-effector from Cartesian coordinates to joint coordinates for N-LINKS.
- Created a program on MATLAB using the same logic, with a GUI where the user can select the end-point and build constraints within the workspace. The algorithm would solve for an optimum configuration of the links reaching the desired end-point and avoiding the constraints.

Development of Cavitation Jet Erosion Test Rig   **IIT Ropar**

- Designed and fabricated a Cavitation Erosion Test Rig to estimate cavitation erosion resistance of different materials.
- Used Solid Works and AutoCAD to make detailed design of the entire setup.

WORK EXPERIENCE

Graduate Teaching Assistant   **North Carolina State University**

- Evaluated student performance, provided feedback, and assigned grades for 30-50 students per semester.
    - Real time robotics and Airfoil theory (Graduate level)
    - Rocket propulsion, Aircraft Propulsion, and Aero II (Undergraduate level)
- Simulated robotic manipulator motions for teaching aid in the graduate level robotics course.
    - Developed a GUI to demonstrate the forward and inverse kinematics of three different 3D manipulators.
    - Animated the motion from the given input states to the end states and incorporated complex motions in the GUI code for the inverse kinematic problem.

Hindustan Aeronautics Ltd. - India   **Summer Intern**   May 2011 – July 2011
Engine Test Bed Research & Development Centre

- Assisted Design group in developing part drawings using AutoCAD and Solidworks.
- Designed a model of converging-diverging nozzle and simulated compressible flow using ANSYS Fluent.
- Studied technology and development of small aviation engines and start-up units.
- Realized importance of work flow structure in a research based organization.

LANGUAGES AND TECHNOLOGIES

- MATLAB, Fortran, AutoCAD, Solidworks, ANSYS Fluent and CFX, XFOIL, PROFOIL – (Proficient)
- Python, LabVIEW, STAR-CCM+, Catia – (Prior Experience)

TECHNICAL PAPERS

- Saini, A., Kim, T., Cui, Z., Schuessler, B., Palmieri, F., Lin, Y., Connell, J., Jiang, X., Zhu, Y., Gopalarathnam, A. and Wohl, C., 2017. Aerodynamic Flow Sensing with Elastic Microfence Structures. In 55th AIAA Aerospace Sciences Meeting (p. 0479).
- Saini, A., & Gopalarathnam, A. (2015). Determination of Section Aerodynamic Operating Condition on Wings and Rotor Blades from Leading-Edge Pressure Measurements. In 33rd AIAA Applied Aerodynamics Conference (p. 3290).
- Kim, T., Saini, A., Kim, J., Gopalarathnam, A., Zhu, Y., Palmieri, F.L., Wohl, C.J. and Jiang, X., 2016. Piezoelectric Floating Element Shear Stress Sensor for the Wind Tunnel Flow Measurement. IEEE Transactions on Industrial Electronics.

HONORS AND ACTIVITIES:

- **Designed the official logo of Indian Institute of Technology, Ropar.**
- Production team member of Maitri – Indian Graduate student organization at N.C State University.
- Fine Arts Representative of IIT Ropar (2010 – 2011) and organizer of Inter-hostel Fine Arts events.
- Coordinator of the Creative team for the cultural festival 'ZEITGEIST 10' at IIT Ropar.