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Objective

To pursue higher studies in the field of aerospace, specifically controls and to capitalize on my interest in robust control to conduct research in the field. Related interests are in the field of optimization, structural dynamics and non-linear control.

Education

- **PhD., Aerospace Engineering** December 2010
University of Florida, Gainesville, FL
G.P.A. 3.93/4.0
Dissertation: “*Control Oriented Design to Optimize Structure for Closed-loop Performance*”
- **M.S., Aerospace Engineering** December 2008
University of Florida, Gainesville, FL
G.P.A. 3.91/4.0
Thesis: “*Control Oriented Analysis of Aerothermoelastic Effects for a Hypersonic Vehicle*”
- **B.E.** June 2006
V.J.T.I., Mumbai University, India
Grade: 1st class with *Distinction*

Research and Work Experience

- **Research Assistant** January 2007 - Present
Department of Mechanical and Aerospace Engineering
University of Florida, Gainesville, FL
 - *Research Synopsis:* In recent years, the multi-disciplinary aspect of design has been considered wherein emphasis has been on improvements possible due to interaction between different disciplines. Simultaneous design and optimization approach for structural systems has been suggested in literature. This design approach enlarges the system boundary to encompass an integrated view of system design. The complexity lies in the interactions of the different sub-systems, but it reduces the design cycle time and ensures that mission requirements are met at the preliminary design stage itself. This research uses surrogate-based design optimization for the control-oriented design problem, which focuses on the simultaneous ‘structural optimization/ controller design’ problem. The three control synthesis techniques used in this study are H_2 , H_∞ , and Linear Parameter Varying (LPV) theory. This study considers the example of the design of a controller to account for the undesired effects of aerothermoelasticity in hypersonic flight and describes the process of control-oriented analysis to suggest a better thermal protection system and a controller for the vehicle.

- **Teaching Assistant** January - May 2007
 Department of Mechanical and Aerospace Engineering
 University of Florida, Gainesville, FL

 - Responsibility included grading assignments, exams, preparing solutions, recording grades etc.

- **CFD Engineer** July - November 2007
 Zeus Numerix Private Limited
 Mumbai, India
<http://www.zeusnumerix.com>

 - Work responsibility included generation of grid, processing and post processing for aerospace applications using the CFD software developed by the company.

- **Project Internship** November - December 2005
 Department of Aerospace Engineering
 IIT Bombay, Mumbai, India

 - Aerodynamic Analysis of Mini Aerial Vehicle (MAV) using AVL: AVL has a large number of features intended for rapid aircraft configuration analysis. The input geometric configuration files were created using the geometry of a MAV developed by IIT Bombay. Then the software was used to calculate various aerodynamic parameters like the variations of the lift and the pitching moments with the angle of attack and the slope of the pitching moment v/s roll rate curve. Xfoil was also used for the airfoil analysis.

- **Summer Internship** May - August 2004
 Department of Aerospace Engineering
 IIT Bombay, Mumbai, India

 - Power plant Characterization for a MAV: The process of characterization of the different MAV propellers using an I.C. engine was carried out to study the characteristics of different propellers and in the long run to finally optimize the efficiency of the propellers and design propellers with the help of this data. With this in mind, a special setup for the propeller characterization and determination of the S.F.C. of the I.C. Engine was fabricated. Following the fabrication, necessary calibration experiments were performed and the results analyzed. After the results were analyzed it helped to select the propeller, engine and the fuel to maximize the efficiency of the engine.

 - Development of a Fortran code to Estimate the Pitching Moment of an aircraft : This code was validated with the available example and used to calculate the pitching moment of the MAV.

Publications

- **Journal Publications**

- **S. Bhat** and R. Lind, “Linear Parameter-Varying Control for Variations in Thermal Gradients across Hypersonic Vehicles,” *Journal of Aerospace Engineering*, in review.
- Z.D. Wilcox, W. MacKunis, **S. Bhat**, R. Lind and W.E. Dixon, “Lyapunov-Based Exponential Tracking Control of a Hypersonic Aircraft with Aerothermoelastic Effects,” *Journal of Guidance, Dynamics and Controls*, in review.
- **S. Bhat**, F. Vianna, and R. Lind, “A Surrogate-Based Design Optimization Approach to Optimize Structure using Linear-Parameter Varying Control Synthesis,” in preparation.
- **S. Bhat**, F. Vianna, R. Lind and R. Haftka, “A Framework for Control-Oriented Design using H_∞ Synthesis and Surrogate-Based Optimization,” in preparation.
- **S. Bhat**, F. Vianna, and R. Lind, “Control-Oriented Design of Aerothermoelastic effects for a Hypersonic Vehicle,” in preparation.

• Conference Publications

- **S. Bhat**, F. Vianna, R. Lind and R. Haftka, “A Framework for Control-Oriented Design using H-infinity Synthesis and Surrogate-Based Optimization,” *AIAA Multidisciplinary Design Optimization Specialist Conference*, Orlando, FL, April 2010, accepted.
- **S. Bhat** and R. Lind, “Linear Parameter-Varying Control for Variations in Thermal Gradients across Hypersonic Vehicles,” *AIAA GNC Conference*, Chicago, IL, August 2009.
- Z. D. Wilcox, **S. Bhat**, R. Lind and W. E. Dixon, “Control Performance Variation due to Nonlinear Aerothermoelasticity in a Hypersonic Vehicle: Insights for Structural Design,” *AIAA GNC Conference*, Chicago, IL, August 2009.
- **S. Bhat** and R. Lind, “Control-Oriented Analysis of Thermal Gradients for a Hypersonic Vehicle,” *American Control Conference*, Invited Paper, St. Louis, MO, June 2009.
- Z.D. Wilcox, W. MacKunis, **S. Bhat**, R. Lind and W.E. Dixon, “Nonlinear Control of a Hypersonic Aircraft in the Presence of Aerothermoelastic Effects,” *American Control Conference*, St. Louis, MO, June 2009.
- **S. Bhat** and R. Lind, “Control-Oriented Design for Vibration Attenuation of Aerothermoelastic Effects,” *International Forum on Aeroelasticity and Structural Dynamics*, Seattle, WA, June 2009.

Proposals

- R. Lind and **S. Bhat**, “Control-Oriented Design”, National Science Foundation, \$ 350,491, April 2010 to March 2013, *in review*.

Presentations

- **S. Bhat** and R. Lind, “Linear Parameter-Varying Control for Variations in Thermal Gradients across Hypersonic Vehicles,” *AIAA GNC Conference*, Chicago, IL, August 2009.
- **S. Bhat** and R. Lind, “Control-Oriented Analysis of Thermal Gradients for a Hypersonic Vehicle,” *American Control Conference*, St. Louis, MO, June 2009.

- P. B. Kumar, N. K. Gupta, N. Ananthkrishnan, V.S. Renganathan, Park, Ik Soo and Yoon, Hyun Gull, “Modeling, Dynamic Simulation, and Controller Design for an Air-breathing Combustion System,” AIAA ASM Conference, Orlando, FL, January 2009. *Presented on behalf of Dr. N. Ananthkrishnan.*
- **S. Bhat** “Modeling and Control of Aerothermoelastic Effects on Hypersonic Vehicles”, *AIAA Student Conference*, Cocoa Beach, FL, March 2008.

Awards and Achievements

- International Student Outstanding Achievement Award, College of Engineering, University of Florida, November 2009.

Selected Coursework and Projects

- EGM 6934 : Robust Control Synthesis
Project : *Robust Controller Design for an Autopilot of a Missile using H_∞ and μ synthesis theory.* The aim of this project was to familiarize the students with the different linear robust control strategies and concepts like H_∞ and μ synthesis, uncertainty modeling as applied to a real world problem.
- EML 5311 : Control System Theory
Project : *Design of a LQR and PID Controller for an Aerospace System with Limit Cycle Oscillation.* The aim of this project was to give students a hands-on experience of developing controllers using PID and LQR techniques and to understand the properties of the closed-loop systems with different controllers.
- EML 6281 : Robot Geometry I
Project : *Kinematic Analysis of a Flexible Aircraft.* The intention of this project was to develop a sound understanding of concepts like transformation matrices, quaternions, forward kinematics, inverse kinematics and apply it to a practical example.
- EML 6934 : Optimal Control
Project : *Trajectory Optimization for a Reentry Vehicle using Indirect Method (Shooting and Multiple-shooting) and Direct Method (LG and LGR Orthogonal Collocation).* The objective of this project was to apply the different optimal control methods and concepts to an aerospace application.
- EAS 6939 : Non-Linear Control I
Project: *Tracking Controller for a Robot Manipulator having uncertainties using Exact Model Knowledge, Robust, Adaptive and RISE controllers.* The aim of this project was to reinforce concepts of stability and performance for non-linear system along with different control strategies like adaptive control, robust control etc. for non-linear systems.
- EEL 5525 : Foundations of Digital Signal Processing
Project :
– *Sampling and DFT/FFT applications in Audio Processing*

– *Develop an Orthogonal Frequency Division Multiplexing Simulator*

– *Application of 2-D FIRs and FFTs in Image Processing.*

- EML 6934 : Optimal Estimation

Project: *A New Technique for Nonlinear Estimation.* The objective of this paper is to understand the filter developed in the paper, ‘A New Technique for Nonlinear Estimation’ and to implement it using an example.

- EEL 6935 : Advanced Topics in System and Control Theory

Project: *Control-oriented Design using H_∞ theory and non- H_∞ performance metrics.* The intention of this project is to further understand the control-oriented design methodology proposed and to try different performance metrics and design variables.

Service

- Volunteer of UFlorida chapter of *Asha for Education*, a charitable organization supporting education of underprivileged children since Summer 2007. Served as the chapter treasurer between Summer 2007 and Summer 2009 managing funds around USD 10,000 - 15, 000 a year. Currently serving as the chapter co-ordinator.

Website : www.ashanet.org/uflorida

- Central treasurer of the ‘*Work an Hour 2009*’ campaign of *Asha for Education* which ran from July 15th and Sept 15th 2009. Donors from across the globe contribute to the cause and the campaign has raised more than \$120,000 to date. Responsibility includes managing and disbursing funds to projects working for the upliftment of underprivileged children in India.

Website: <http://www.workanhour.org>

- Associated with the ‘*Children Home Society of Florida, mid-Florida division*’, a child protection and adoption agency during Fall 2008.

Website : <http://www.chsfl.org/>

Activities

- Attended ‘Iterations’ (Computation Fluid Dynamics) Workshop at Techfest 2006, I.I.T. Bombay and secured the Top position in the Competition held on Computational Fluid Dynamics.
- Attended Aeromodelling workshop conducted by IDEAS, Department of Aerospace Engineering, IIT Bombay.
- Headed the Aeromodelling workshop for the national level event, Technovanza 2004, VJTI, Mumbai.
- Headed a technical event for the national level technical festival, Technovanza 2004, VJTI, Mumbai.
- Coordinated a session in Blueprint 2020, a national level seminal conference on Engineering Academic Transformation.
- Attended seminars conducted by well-known luminaries in the field of astrophysics at Nehru Planetarium, Mumbai, India.

- Participated in the 15k '*Gate River Run 2008 and 2009*' held in Jacksonville, FL.

Computational Skills

- Programming languages: FORTRAN, C, C++
- Operating Systems: Microsoft XP and Linux Red Hat
- Applications: Microsoft Office, Auto-Cad, SolidWorks, MATLAB and AVL