

Matias A. Oyarzun

CONTACT

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OBJECTIVE

To engage in the design, modeling, analysis, and testing of state-of-the-art systems by obtaining a full-time engineering research position

PROFILE

Doctorate in mechanical engineering with experience in fundamental and experimental fluid dynamics, specifically particle image velocimetry, acoustical analysis of systems, data measurement, processing and analysis, and the modeling, design, optimization, fabrication and testing of electromechanical-acoustical devices. Adept at developing system-level design tools, designing experiments and problem solving.

EDUCATION

Doctor of Philosophy | Mechanical Engineering **July 2014 (Expected)**
University of Florida, Gainesville FL

- Thesis: “On the Design and Optimization of Zero-Net Mass-Flux (ZNMF) Actuators for Active Flow Control Applications.”
- Advisor: Louis N. Cattafesta III
- GPA: 3.83/4.0

Master of Science | Mechanical Engineering **August 2008**
University of Florida, Gainesville FL

- GPA: 3.80/4.0

Dual Bachelor of Science | Aerospace Engineering & Mechanical Engineering **December 2005**
University of Florida, Gainesville FL

- GPA: 3.70/4.0, Dean’s List 2004-2005
- Graduated Cum Laude

EXPERIENCE

Graduate Research Assistant | University of Florida, Gainesville FL **January 2006 – Present**
Interdisciplinary Microsystems Group

- **Digital image processing and correlation analysis.** Utilized image correlation analysis to detect the displacement of suspended particles in air, otherwise known as particle image velocimetry (PIV), for various low-speed flows. Experience with both two-dimensional and stereoscopic PIV.
- **Wind tunnel facility development and experience.** With the aid of derived analytical tools and computation fluid dynamics (CFD), optimized and designed a low-speed, low Reynolds number wind tunnel facility at the University of Florida’s Research and Engineering Education Facility for use in research of micro-air vehicles. Performed low-speed wind tunnel tests to investigate the fluid-structural interactions over a flat-plate airfoil model retrofitted with a custom designed unsteady piezoelectric actuator array.
- **Signal processing and data analysis.** Applied Fourier and spectral methods to determine the frequency characteristics for various signals/instruments including unsteady pressure sensors, hot-wire anemometers and accelerometers. Calculated statistical quantities and performed uncertainty analysis for acquired data using, for example, Monte Carlo simulation.
- **Data acquisition.** Using NI data acquisition hardware and a suite of NI tools including LABVIEW, acquired data for air pressure, velocity, unsteady acoustics, and structural vibration acceleration.
- **Hardware development and sensor selection.** Designed and manufactured several piezoelectric synthetic jet actuators for my personal research efforts as well as for other researchers as part of a collaborative effort. Fabricated a custom hot-wire anemometer that was incorporated into a printed circuit board used for real-time velocity measurements and health monitoring. Selected and installed flow and structural transducers based on necessary performance metrics. Sensors include microphones, static pressure transducers, hot-wire anemometers, and accelerometers.
- **Actuator modeling and optimization.** Modeled electromechanical-acoustical devices that utilize different transduction schemes (piezoelectric and electromagnetic/voice-coil). Derived system-level design tools for predicting the performance of synthetic jet actuators which were validated using MATLAB and FEM software such as COMSOL Multiphysics and ABAQUS. Developed an open source constrained design optimization/analysis tool in MATLAB that enables the design of customizable electromechanical actuators subject to various objective functions.
- **Interdisciplinary collaboration and leadership.** Worked alongside and collaborated with individuals from various disciplines including electrical, mechanical and aerospace engineering.

Provided expertise and technical oversight to undergraduate students on flow control projects. Co-authored a chapter in a book on the state-of-the-art in synthetic jet actuators entitled *Synthetic Jets: Fundamentals and Applications*, Chapter 2 Design of Synthetic Jets: Design principles and tools for synthetic jets.

Research Consultant | Interdisciplinary Consulting Corporation, Gainesville FL

The Boeing Company

September 2007 | August 2010

- Generated and validated a lumped element model of a meso-scale voice-coil type electromechanical actuator as part of a collaborative research effort.
- Actualized and implemented a MATLAB code for modeling the performance of piezoelectric composite plates, extending the existing model to include pinned, clamped and compliant boundary conditions and multi-layer piezoelectric disc designs.

Teaching Assistant | University of Florida, Gainesville FL

Spring 2005 – Fall 2009

- *Courses:* Fluid Mechanics, Intermediate Engineering Analysis, Aerodynamics.
- Instructed 30+ undergraduate students in semi-weekly recitation sections.
- Developed a comprehensive set of course notes and other course materials, prepared lesson plans, quizzes and graded course materials.
- Held regular office hours and tutored students on an individual basis.

TRAINING

University of Florida | Gainesville FL

January 2006 – Present

Selected Coursework: Advanced Structural Composites, Finite Element Analysis, Approximation and Optimal Design, Data Measurement & Analysis, Acoustics, Electroacoustics, Inviscid Fluid Flows, Viscous Fluid Flows, Incompressible Flow, Turbulence

SKILLS

Software: Abaqus | AutoCAD | COMSOL Multiphysics | DaVis | Dantec Streamware | Fluent | LabVIEW | MATLAB | Mathcad | Pro-E | Solidworks |

Experimental: 3-axis and single axis accelerometer measurements, stereoscopic and 2D particle image correction analysis, constant temperature hot-wire anemometry, microphone measurement techniques, two-microphone method, spectral analysis and uncertainty measurement

AWARDS

University of Florida Alumni Graduate Fellowship Recipient, 2006– 2011

Florida Bright Futures Scholarship Recipient, 2001-2005

SELECTED

PUBLICATIONS

Book Chapter:

- Cattafesta, L. and **Oyarzun, M.**, *Synthetic Jets: Fundamentals and Applications*, Chapter 2 Design of Synthetic Jets: Design principles and tools for synthetic jets, in press.

Journal:

- Sawant, S., **Oyarzun, M.**, Sheplak, M., Cattafesta, L., and Arnold, D., “Modeling of Electrodynamical Zero-Net Mass-Flux Actuators”, *AIAA Journal*, vol. 50, no. 6, pp. 1347-1359, 2012.
- Takahashi, H., Liu, F., Palavicchini, M., **Oyarzun, M.**, Griffin, J., Ukeiley, L., and Cattafesta, L., “Experimental Study of Adaptive Control on High-Speed Flow-Induced Cavity Resonance”, *Journal of Fluid Science and Technology*, vol. 6, no. 5, pp. 701-716, July 2011.

Conference:

- Griffin, J., **Oyarzun, M.**, Cattafesta, L.N., Tu, J.H., Rowley, C.W., and Mittal, R., "Control of a Canonical Separated Flow", *43rd AIAA Fluid Dynamics Conference, AIAA 2013-2968*, San Diego, California, June 2013.
- Takahashi, H., Liu, F., Palavicchini, M., **Oyarzun, M.**, Griffin, J., Ukeiley, L., and Cattafesta, L., “Progress on Active Control of Open Cavities”, *49th AIAA Aerospace Sciences Meeting, AIAA 2011-1221*, Orlando, Florida, January 2011.
- **Oyarzun, M.** and Cattafesta, L., “Design and Optimization of Piezoelectric Zero-Net Mass-Flux Actuators”, *5th AIAA Flow Control Conference, AIAA Paper 2010-4414*, Chicago, Illinois, June 2010.

For a complete list of publications (1 book, 4 journal, 6 conference) see www.img.ufl.edu/users/matias-oyarzun