Zachary del Rosario

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Education

PhD	Stanford University	Aeronautical and Astronautical Engineering	2020
	Co-advisors:	Gianluca Iaccarino and Art B. Owen	
MS	Stanford University	Aeronautical and Astronautical Engineering	2018
BS	Olin College of Engineering	Mechanical Engineering	2014

PhD Thesis

"Principled Marins: Rigorous Tools and Strategies for Aircraft Design Under Uncertainty"

Competitive aircraft design walks the razors edge, balancing weight reduction with aircraft safety. Design tends to lean conservative, with cascaded margins to address uncertainties. This thesis introduces design margins that *provably* yield minimal weight penalties at desired levels of safety. Comparisons against industry standards, tractable approximations, and ramifications for both conceptual and detailed design are considered.

Grants and Fellowships

Source	For	Size	
DIF Grant, Vice Provost for Graduate Education *Grant to support outreach activities, Stanford internal*	SeeME	$1,500	2019
Teaching Advancement Grant, Vice Provost for Teaching and Learning *Travel grant to attend NABI summit 2019, Stanford internal*	SeeME	~$470	2019
SPICE Grant, Vice Provost for Graduate Education *Grant to support club activities, Stanford internal*	ASEE	$2,500	2018
Teaching Advancement Grant, Vice Provost for Teaching and Learning *Travel grant to attend ASEE Annual Conference 2018, Stanford internal*	ASEE	~$800	2018
Diversifying Academia, Recruiting Excellence (DARE) Fellowship *Competitive fellowship for promising faculty candidates, Stanford internal*	-	~$116,000	2018
Statistical Perspectives on UQ (SPUQ) travel award *Travel grant to attend SPUQ 2017, SAMSI-funded*	-	$500	2017
Stanford Speaker's Bureau Co-sponsorship *Pitch-based funding for ASEE Colloquium 2017, Stanford internal*	ASEE	$1,500	2017
NSF Graduate Research Fellowship	-	~$300,000	2015

Honors and Awards

Stanford MECON Oral Presentation award, 1st place 2017
Mechanical Engineering Department-sponsored speaker competition

AIAA Jefferson Goblet Best Student Paper 2017
Highest honor for student papers at AIAA SciTech annual conference

Refereed research papers

1. del Rosario, Z., R. Fenrich, and G. Iaccarino (2019a). Cutting the Double Loop: Theory and Algorithms for Reliability-Based Design Optimization with Statistical Uncertainty. *International Journal for Numerical Methods in Engineering*. eprint: https://doi.org/10.1002/nme.6035.
2. del Rosario, Z., G. Iaccarino, and R. W. Fenrich (2019). Fast Precision Margin with the First-Order Reliability Method. *AIAA Journal*. eprint: https://doi.org/10.2514/1.J058345.
3. del Rosario, Z., M. Lee, and G. Iaccarino (2019). Lurking Variable Detection via Dimensional Analysis. *SIAM / ASA Journal on Uncertainty Quantification*. eprint: https://doi.org/10.1137/17M1155508.

Invited talks

1. del Rosario, Z. (Oct. 2019c). The Curse of Dimensionality: Problems and Strategies. In: NATO/STO Lecture Series: Uncertainty Quantification in Computational Fluid Dynamics. https://we.stanford.edu/LSUQ.
2. del Rosario, Z., R. Fenrich, and G. Iaccarino (July 2019b). Principled Margin. In: Arevo, Inc.
3. del Rosario, Z. (Sept. 2018a). Lost in Hyperspace: The Curse of Dimensionality. In: Wellesley College student seminar.

4. del Rosario, Z. (Oct. 2018b). The Curse of Dimensionality: Problems and Strategies. In: von Karman Institute: Uncertainty Quantification in Computational Fluid Dynamics (STO-AVT 326).
5. del Rosario, Z., A. Towne, and G. Iaccarino (2018c). Dimension Reduction for Shape Design Insight. In: Aerospace Computational Design Lab (ACDL) seminar, MIT.

Papers in conference proceedings

1. del Rosario, Z., R. W. Fenrich, and G. Iaccarino (2020). When are Design Allowables Conservative? In: *AIAA SciTech 2020 Forum*.
2. del Rosario, Z., R. W. Fenrich, and G. Iaccarino (2019a). Beyond Basis Values: Fast Precision Margin with FORM. In: 21st AIAA Non-Deterministic Approaches Conference.
3. del Rosario, Z., R. W. Fenrich, and G. Iaccarino (2019b). Margin as Model: Some Answers to "How Many Tests Should I Perform?". In: *AIAA Aviation 2019 Forum*.
4. del Rosario, Z., A. Towne, and G. Iaccarino (2018b). Dimension Reduction for Shape Design Insight. In: 20th AIAA Non-Deterministic Approaches Conference.
5. del Rosario, Z., P. Constantine, and G. Iaccarino (2017c). Developing Design Insight Through Active Subspaces. In: 19th AIAA Non-Deterministic Approaches Conference.

Pre-prints

1. Constantine, P. G., Z. del Rosario, and G. Iaccarino (2017). Data-driven dimensional analysis: algorithms for unique and relevant dimensionless groups. *arXiv preprint arXiv:1708.04303*. Forthcoming in JCP.
2. Constantine, P. G., Z. del Rosario, and G. Iaccarino (2016). Many physical laws are ridge functions. *arXiv preprint arXiv:1605.07974*.

Conference talks

1. del Rosario, Z. (2019a). Machine Learning for Materials Property Prediction. In: North American Solid State Chemistry Conference.
2. del Rosario, Z. (2019b). Stanford SeeME: Student-driven research within an R1 institution. In: National Alliance for Broader Impacts (NABI) Summit.
3. del Rosario, Z., A. Banko, A. Horwitz, and G. Iaccarino (2018). Data-Driven Physical Inquiry: Discovering Relevant Dimensionless Numbers With Physics-Constrained Machine Learning. In: 71th Annual Meeting of the American Physical Society, Division of Fluid Dynamics.
4. del Rosario, Z., A. Towne, and G. Iaccarino (2018a). Dimension Reduction for Shape Design Insight. In: Thermal, Fluid science Sponsors, and Affiliates conference (TFSA).
5. del Rosario, Z., P. Constantine, and G. Iaccarino (2017a). Algorithm-Driven Insight. In: Thermal and Fluid Science Affiliates Conference.
6. del Rosario, Z., P. Constantine, and G. Iaccarino (2017b). Data-Driven Dimensional Analysis. In: CompFest.
7. del Rosario, Z., M. Lee, and G. Iaccarino (2017). Discovering Hidden Controlling Parameters using Data Analytics and Dimensional Analysis. In: 70th Annual Meeting of the American Physical Society, Division of Fluid Dynamics.
8. del Rosario, Z., A. Towne, and G. Iaccarino (2017). Handling Classes of Variables in Dimension Reduction. In: SIAM Workshop on Parameter Space Dimension Reduction (DR17).

Poster presentations

1. del Rosario, Z. and G. Iaccarino (2017). Hidden Parameter Hypothesis Testing. In: Statistical Perspectives on Uncertainty Quantification.
2. Torres, H., Z. del Rosario, and G. Iaccarino (2017). MCRT. In: WEST Conference.

Teaching Experience

Course Instruction

Uncertainty Quantification, (ME 470) Stanford — Spring 2019
Designed, implemented, and delivered graduate-level elective course for 9 advanced students. Taught using a mixture of lecture and evidence-based methods. Sought professional consultation for mid-quarter feedback and implemented changes.

Uncertainty Quantification, (ME 470) (Two lectures) Stanford — Winter 2018
Guest lecturer. Developed two lectures, supporting notes, and designed a homework to reinforce content. Iterated on this content in 2019.

Workshops

Materials Informatics Workshop, (Citrine Informatics) Georgia Tech — 2019
Designed and facilitated a two-day workshop on materials informatics at Georgia Tech, sponsored by the Institute for Materials. Led a team of 7 TA's to teach ~ 15 *participants.*
https://citrineinformatics.github.io/ga-tech-workshop/

Teacher Workshops, (SeeME) Stanford — 2019
Developed and delivered workshops on the fundamentals of teaching, including lessons on learning goals and The 5E Model. Ran workshops for audiences of ~ 10.

Groupwork Workshop, (VPTL Consultant) Stanford — 2018-2019
Co-developed and delivered workshop on evidence-based best-practices for groupwork in the classroom. Digested, summarized, and applied education literature, designed hands-on activities, co-facilitated workshop on several occasions for audiences of ~ 16.

Outreach

Intro to Exploratory Data Analysis, (SeeME) Stanford — 2016
Introductory hands-on class to introduce students to principles of visualization, exploring data, understanding trends, and basic causal reasoning.
https://github.com/zdelrosario/teaching-eda

"What the heck is engineering?", (Splash) Stanford — 2014-2015
Introductory discussion-based class meant to introduce middle- and high-school aged students to engineering as a profession.

Assistantships

Applied Aerodynamics, (AA 200) Stanford — 2016
Held office hours, graded homeworks and exams.

Partial Differential Equations, Olin College — 2014
Held office hours, graded homeworks and exams.

Machine Shop Instructor, Olin College — 2014
Taught basic machine shop operations, milling, turning, shop safety.

Transport Phenomena, Olin College — 2013
Heat transfer and fluid mechanics; held office hours, graded homeworks and exams.

Linearity, Olin College — 2012
Introductory linear algebra; held office hours, graded homeworks and exams.

Mentoring

Writing		Outcome	
Cindy Nguyen	Research and Personal Statements	NSF GRFP; Stanford, Dept. of Electrical Engineering	2019
Larissa Little	Personal Statements	NDSEG; Harvard, Dept. of Materials Science	2018
Mason del Rosario	Research and Personal Statements	NSF GRFP Honorable Mention, UC Davis, Dept. of Electrical Engineering	2018
Rongfei Lu	Personal Statements	Stanford, Dept. of Aeronautics and Astronautics	2018
Emma (Zeyan) Xu	Research and Personal Statements	NSF GRFP, Columbia, Dept. of Material Science	2017
Research		**Project**	
Mark Benjamin	Advisor	Advised rotation student on investigation of reliability-based design optimization strategies, focusing on comparing various density-matching approaches.	2018

Service and Leadership

Co-Chair (ASEE, Task Force on Graduate Student Affairs) 2019-Present

Appointed by the president of the American Society for Engineering Education (ASEE) national organization to co-chair a task force studying how our professional society can serve graduate students.

President (American Society for Engineering Education, Stanford Chapter) 2018-2019

Led and served on a 5-person organizing team. Organized a seminar sequence with internal and external speakers. Directed a Colloquium event attended by 70 persons, featuring workshops on "The Fundamentals of Teaching."

Founder and Director of Curriculum (SeeME) 2017-Present

Co-founded Stanford Mechanical Engineering's student-run research outreach program SeeME. Developed and delivered workshops to train grad student instructors. Wrote grants to support operations and conference travel. Served as program leader and interfaced with the Department Chair.

Financial Officer (American Society for Engineering Education, Stanford Chapter) 2017-2018

Served on 4-person organizing team. Wrote and won grants to fund speaker series and Colloquium. Point person on organizing seminar sequence.

Chair of Teacher Development (Stanford Splash) 2014-2016

Served on 20-person organizing team serving thousands of high school students. Owned our teacher training training program; co-facilitated workshops to introduce Stanford students to the basics of teaching. Enhanced teacher evaluations by introducing new survey system.

Robotics Mentor (FIRST Robotics, Team 751) 2014-2016

Volunteered on 3-mentor team for a high-school robotics program. Taught machine shop operations (milling and turning), mechanical design and drawing, coordinated travel logistics for away competitions.

Employment

Statistical Consultant (Citrine Informatics) October 2019-Present

Supporting government-funded research projects with numerical and graphical statistical analyses. Co-author on resulting publications.

Instructional Designer and Data Scientist (Citrine Informatics) Summer 2019

Developed and delivered 2-day workshop at Georgia Tech on Materials Informatics. Developed novel strategies for active learning in support of materials discovery.

Teaching Consultant (Stanford VPTL) 2018-Present

Professional teaching consultant, employed by the office of the Vice Provost for Teaching and Learning (VPTL). Used training in pedagogy and mentorship to carry out consultations with fellow graduate students. Co-facilitated various workshops, and co-developed novel workshop material on Groupwork.

Research intern (Northrop Grumman Corporation) Summer 2017

Developed statistical methods to identify anomalies in time series data. Supported exoplanet detection research team.

Licenses and Certifications

- Private Pilot, Single engine land, Certificate Number 3386055
- Amateur radio operator, Technician Class, callsign KC3HMT

Skills

Academic	Linear Algebra, Aerodynamics, Optimization, Statistics, User-Centered Design
Computer	Python, R/Tidyverse, c++, MATLAB, MPI, Legion/Regent, Unix, SolidWorks, LaTeX
Machine Shop	Manual and CNC milling, Manual turning, Laser cutting

The Engineer's Entreaty:
"Grant me the Insight to abstract the things I do not need,
Tenacity to understand the things I require,
And Wisdom to know the difference."