

CASEY MARGARET FLEETER

Cardiovascular Biomechanics Computation Lab
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EDUCATION

Stanford University, Stanford, CA **Expected June 2020**

Ph.D. Candidate in Computational and Mathematical Engineering
Advisors: Prof. Alison Marsden, Ph.D and Prof. Daniele Schiavazzi (University of Notre Dame), Ph.D.

Stanford University, Stanford, CA **April 2018**

M.S. in Computational and Mathematical Engineering

Harvard University, Cambridge, MA **May 2015**

B.A. in Physics, Minor in Mathematical Sciences

RESEARCH EXPERIENCE

Stanford University Institute for Computational and Mathematical Engineering, Stanford, CA

Cardiovascular Biomechanics Computation Lab – PhD Candidate **January 2016 – Present**

➤ **Multi-Fidelity Solver Fidelity Conversion Pipeline.**

- Coupled existing 1D and 3D computational fluid dynamics solvers in the lab by implementing a Python pipeline.
- Pipeline allows lab members to automatically extract the 1D model geometry from existing 3D models.
- Allows users to utilize less computationally expensive 1D solver for a variety of future projects.
- Pipeline validated against 3D model simulations for different cardiovascular anatomies including aorto-femoral, coronary and pulmonary cases.
- Essential for multi-fidelity uncertainty quantification.

➤ **Multi-Level Multi-Fidelity (MLMF) Uncertainty Quantification Framework.**

- Implemented MLMF uncertainty quantification framework for cost effective uncertainty quantification for CFD simulations of the cardiovascular system.
- Designed framework to be easily usable to other users of our software and Sandia's DAKOTA toolkit.
- Significantly reduced the setup burden on future users wishing to perform UQ.
- Significantly reduces the computational cost of performing UQ.
- MLMF Dakota-Simvascular framework can handle any number of uncertain parameters and quantities of interest, making it reusable and extensible for different use cases.
- Performs well on different vasculatures, including aorto-femoral and coronary models.

Ohio State University Bioinformatics Department, Columbus, OH

Huang and Marsh Lab – Undergraduate Researcher **May 2014 – September 2014**

- Analyzed data sets with DNA methylation methods in Matlab to explore tissue aging as a predictor for cancer.
- Recreated work in breast cancer by Steve Horvath and applied similar methods to new data sets for lung cancer.

Harvard University Physics Department, Cambridge, MA

Gabrielse Lab – Undergraduate Researcher **May 2013 – September 2013**

- Explored properties of antihydrogen using Ioffe Traps as a member of ATRAP Project Team.
- Repaired internal electronics of BiasDAC voltage regulators through maintenance of integrated circuit components.
- Tested devices outputs using LabVIEW and calibrated using data analysis in IgorPro.
- Presented at Harvard PRISE to the community of fellow scholars as culmination of the STEM research program.

PROFESSIONAL EXPERIENCE

Sandia National Laboratories, Albuquerque, NM

Optimization & UQ Group 01441 – Graduate Student Intern

June 2017 – September 2017

- Implemented a Multi-Level Multi-Fidelity framework for use with cardiovascular modeling techniques of the Cardiovascular Biomechanics Computation Lab.
- Conducted a preliminary study with this framework, the results of which were published in the peer-reviewed Sandia Intern Summer Proceedings.
- Work in collaboration with Gianluca Geraci (Ph.D.), Michael Eldred (Ph.D.) and James Stewart (Ph.D.).

TEACHING EXPERIENCE

Harvard University School of Engineering and Applied Sciences, Cambridge, MA

Applied Math 21a, 21b, 105 and Computer Science 50 Teaching Fellow

August 2012 – May 2015

- Collaborated with the other TFs and professors to plan curriculum and teaching methodology through weekly staff meetings and grading the homework and exams.
- Implemented these strategies by planning and teaching weekly recitations and assisting students during office hours.
- Awarded Bok Center Certificate of Distinction in Teaching for average student evaluations above 4.5/5.
- Coursework taught included multivariable calculus, linear algebra, ordinary and partial differential equations, Fourier series, and introductory programming topics in C with web design with JavaScript, SQL and PHP.

Computer Science at Margaret J. Kemp

Tutor

August 2018 – Present

- Tutored a high school student weekly at Margaret J. Kemp juvenile hall on introductory computer science using Scratch.
- Will work weekly with the same student for multiple months, to ensure continuity of instruction and build a relationship with the student.

Johns Hopkins Center for Talented Youth (CTY)

Student Organizer and Instructor

April 2017, April 2018

- Hosted high achieving middle school students for an academic enrichment workshop on engineering and cardiovascular medicine.
- Developed and ran workshops to teach exercise physiology and heart valve physiology using hands-on activities.

Beechwood School, Menlo Park

Student Instructor

May 2018

- Guest lectured in middle school science classes to foster scientific interest and serve as a student role model.
- Developed and ran workshops to teach cardiovascular biomechanics using hands-on activities, including virtual reality software.

HONORS AND AWARDS

Stanford EDGE Fellow

September 2015 – Present

- Stanford graduate program with a goal of “recruiting and retaining outstanding doctoral students who have the potential to contribute to the diversity of their academic fields and departments”.
- Includes graduate fellowship for student research support and research related expenses.

OUTREACH AND MENTORING**Stanford Women in Mathematics, Statistics, and Computational Engineering (WiMSCE)***Co-President, Student member***April 2016 – Present**

- Served as a founding member and inaugural co-president for this student and faculty group established with the aim of retaining graduate women in higher education by providing opportunities to interact with their peers and mentors.
- Connected women in mathematical fields to organize speakers, social events, and career advancement workshops to provide professional guidance and support opportunities for members.

Stanford Women in Math Mentoring (SWIMM)*Mentor***September 2016 – Present**

- Mentored two undergraduate women.
- Encouraged undergraduate mentees to pursue their interests in STEM fields through monthly one-on-one meetings and quarterly group meetings.
- Provided insights and resources as younger women navigated summer opportunities, courses, and other challenges.

Reviewer**January 2017 – Present**

- Reviewed scientific articles for publication.
- Topics included uncertainty quantification, fluid mechanics, biomechanics.

Stanford Pre-Major Advising Fellow (PMAF) Advising Program*Advisor***September 2017 – June 2018**

- Served as the academic advisor to two undergraduate sophomores.
- Met at least quarterly with both undergraduates to help with their class and internship career planning, as well as to help with the process of declaring a major.
- Participated in the PMAF program in its pilot year after a selective application process along with other graduate student PMAF advisors.

Association for Women in Science (AWIS)*Mentee***September 2016 – September 2017**

- Connected with a network of professional women in academia and industry to enhance my graduate school experience and eventual career trajectory.
- Joined AWIS, the largest multi-disciplinary organization for women in STEM dedicated to achieving equity and full participation of women in all disciplines and across all employment sectors.

Escondido Elementary School*Volunteer***March 2017**

- Served as a Science Official during elementary school Science Fair and Science Night by judging student projects and fostering scientific interest and curiosity as a graduate student role model.

PROGRAMMING AND COMPUTING SKILLS

- **Programming (highly proficient):** C++, C, Python, Matlab, Linux Shell
- **Programming (proficient):** SQL, HTML, JavaScript/jQuery, AMPL, Assembly, Mathematica
- **Parallel Computing:** MPI, OpenMP, CUDA, mpi4py
- **Data Processing:** Paraview, Excel, Numbers
- **Word Processing:** Microsoft Office Suite, Apple iWork Suite, LaTeX, Markdown
- **Operating Systems:** Mac, Linux, Windows

PEER-REVIEWED PUBLICATIONS

Fleeter C. M., Geraci G., Schiavazzi D., Kahn A.M., Eldred M.S., Marsden A.L., “Multifidelity multilevel approaches for cardiovascular flow under uncertainty”, *Center for Computing Research Summer Proceedings 2017*, A.D. Baczewski and M.L. Parks, eds., Technical Report SAND2018-27800, Sandia National Laboratories, pp. 27-50, 2018.

Fleeter C. M., Geraci G., Schiavazzi D., Kahn A.M., Marsden A.L., “A Multi-Level Multi-Fidelity framework for cardiovascular flow under uncertainty”, In preparation.

CONFERENCE AND SEMINAR PRESENTATIONS

Fleeter C. M., Geraci G., Schiavazzi D., Kahn A., Marsden A., “Multi-fidelity Uncertainty Quantification for Healthy and Diseased Cardiovascular Models”, *13th World Congress in Computational Mechanics*, Talk, New York City, NY, USA, July 22-27, 2018.

Schiavazzi, D. E., Fleeter, C. M., Geraci, G., Marsden, A. L., “Multifidelity Approaches for Cardiovascular Hemodynamics”, *ECCM ECFD*, Talk by D. E. Schiavazzi, Glasgow, Scotland, June 11-15, 2018.

Fleeter, C. M., Geraci G., Schiavazzi, D. E., Kahn A., Marsden A. L., “Multifidelity Uncertainty Quantification for Cardiovascular Hemodynamics”, *ICME Xpo Research Symposium 2018*, Poster, Stanford, CA, USA, May 18, 2018.

Fleeter, C. M., Geraci G., Schiavazzi, D. E., Kahn A., Marsden A. L., “Multi-Fidelity Uncertainty Propagation for Cardiovascular Modeling”, *Stanford CME 500 Departmental Seminar*, Talk, Stanford, CA, USA, March 12, 2018.

Fleeter C. M., Geraci G., Schiavazzi D., Kahn A., Marsden A., “Multi-Fidelity Uncertainty Propagation for Cardiovascular Modeling”, *70th Annual Meeting of the APS Division of Fluid Dynamics*, Talk, Denver, CO, USA, November 19-21, 2017.

Fleeter, C. M., Schiavazzi, D. E., Marsden A. L., “Towards a Multi-fidelity Hemodynamic Model Pipeline for the Analysis of Cardiovascular Flow Under Uncertainty”, *14th U.S. National Congress on Computational Mechanics*, Talk, Montreal, QC, Canada, July 17-20, 2017.

Fleeter, C. M., Schiavazzi, D. E., Marsden A. L., “Towards a Multi-fidelity Hemodynamic Model Pipeline for the Analysis of Cardiovascular Flow Under Uncertainty,” *Summer Biomechanics, Bioengineering and Biotransport Conference*, Poster, Tucson, AZ, USA, June 21-24, 2017.

Fleeter, C. M., Schiavazzi, D. E., Marsden A. L., “Towards a Multi-fidelity Hemodynamic Model Pipeline for the Analysis of Cardiovascular Flow Under Uncertainty,” *ICME Xpo Research Symposium 2017*, Poster, Stanford, CA, USA, May 19, 2017.

Fleeter, C. M., Schiavazzi, D. E., Marsden A. L., “Towards a Multi-fidelity Hemodynamic Model Pipeline for the Analysis of Cardiovascular Flow Under Uncertainty”, *5th International Conference on Computational and Mathematical Biomedical Engineering*, Pittsburgh, PA, USA, April 10-12, 2017.

SELECTED COURSEWORK

Uncertainty Quantification, Model Reduction, Numerical Linear Algebra Numerical and Applied Partial Differential Equations, Stochastic Methods in Engineering, Numerical Optimization, Fluid Mechanics I, Finite Element Analysis, Advanced Software Development for Engineers I & II.

PROFESSIONAL AFFILIATIONS

- **Society for Industrial and Applied Mathematics (SIAM)** Student member
- **American Physical Society (APS)** Student member
- **Association for Women in Science (AWIS)** Student member

REFERENCES FOR CASEY M. FLEETER

Prof. Alison Marsden, Ph.D.

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