Personal Statement

of Dante Buhl (Applied Math PhD applicant for Fall—2024)

Growing up in the Greater Sacramento Area and coming from a low-income family, I had never thought that I would want to become an academic, or at least get a PhD one day. And yet, here I am at 22 years of age with a drive to learn more and make new insights in the field of fluid dynamics. I went to the University of California Santa Cruz as a first-gen student for my undergrad in Mathematics and graduated in 3 short years with a GPA of 3.74 and highest honors in the major. Before my departure, I found a department that was doing a really interesting fusion of mathematics and computer science. This was, of course, the Applied Mathematics Department (later referenced as A.M. Department), which happened to have an amazing 4+1 master's program. This is my current academic position as I am writing this: a graduate student in UC Santa Cruz's A.M. Department.

My undergraduate experience, although overall very strong, had a rough start. This was primarily a result of the online medium of education in my freshman year, at the height of the pandemic. Since most of my assignments and lectures could be done at my leisure, I began working upwards of 55 hours per week in order to support my family. I eventually failed a course due to this practice, and had to re-evaluate my study style. Besides this, some high notes of my undergraduate career were my Directed Reading Program Presentation in the Mathematics Department and a small research project for an "Applied Dynamical Systems" course I took in Fall 2022. The former was a presentation based on a dynamical systems research project I completed in the Winter Quarter of 2023 under the mentorship of John Pelias, a Mathematics PhD student at UC Santa Cruz. This research was focused on numerical methods for computing the fractal dimension of three dimensional chaotic attractors according to the various definitions of fractal dimension. The latter project was an investigation of the Lorenz Ski-Slope system published in Lorenz's book, *The Essence of Chaos*. Our work involved reproducing poincare maps, phase portraits, and even visualizations of the four-dimensional chaotic attractor found in the book. Both research projects relied on Matlab programming and deepened my knowledge of dynamical systems and numerical methods (more information about these projects can be found on my website linked above).

Towards the end of my undergraduate career, I took two graduate level fluid dynamics courses. One was an introductory course taught by Nicholas Brummell from the A.M. Department, and the other by Chris Edwards from the Ocean Sciences department and which focused on Geophysical Fluid Dynamics. These courses cemented my interest in the general subject of fluid dynamics while also preparing me for work in the field.

Upon graduating from UC Santa Cruz in June 2023, I participated in a summer REU program at Towson University in Maryland. The principal investigator for this research was Herve Nganguia, a fluid dynamicist who specializes in math-bio related problems. Our work was focused on using Deep-Learning to find a numerical model which complemented prior analytical work published in a paper by Nganguia concerning the propulsion efficiency of ciliated spherical "squirmers" in Stokes Flow. This program was also focused on preparing participants in research-focused mathemati-

cal work and featured several presentation opportunities. An example being a scheduled presentation at the Joint Mathematics Meeting in January 2024 based on our research. The REU ended at the beginning of August, and I soon after started a new research project in Santa Cruz.

Currently, I am in my first quarter of graduate studies and plan to complete a master's thesis on the effect of rotation on stratified turbuluence in stellar fluids under the guidance of Pascale Garaud, a well-published researcher in astrophysical and geophysical fluid dynamics. This research is a mix of Direct Numerical Simulations and analytical work which utilizes High-Performance Computing resources such as the San Diego Supercomputer Center and will use Garaud's prior findings. In addition to my thesis, I plan to take another course in fluid dynamics titled, "Waves, Instabilities, and Turbuluence", in order to prepare for a PhD on the subject. I will also be working as a Teaching Assistant in order to fund my degree, gain teaching experience, and support lower division mathematics courses within the deparment. The expected time of completion for the degree is the spring or summer of 2024.

Ultimately, I'm a proud and hard-working student who has, within the last year, developed a passion for working with Navier-Stokes and Fluid Dynamics. The prospect of continuing to do advanced research in this field is highly attractive, both in the realms of numerical work and analytical work. My experience with prior research projects has helped me understand in which research situations I thrive in and those which I do not. I'm very excited to do more work in the future and find my place in a new project. Thank you for considering me in your program.