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November 5, 2022

Graduate Admissions
Thayer School of Engineering
Dartmouth College
15 Thayer Drive
Hanover, NH 03755

Dear Thayer School of Engineering Graduate Admissions,

My name is Davis Cole and I am a R&D Verification Engineer at Ansys Inc. in Lebanon. Prior to starting this position, I worked at DEKA R&D in Manchester as a test engineer, aiding in the development of state-of-the-art medical devices. Despite these titles, I have done work for various engineering disciplines to progress project goals. I am confident that I would benefit from graduate studies at Dartmouth by advancing my knowledge in mechanical engineering subjects including thermofluids and applied mathematics, and further developing other skills in software engineering such as high-performance computing. The Fluent computational fluid dynamics (CFD) code I work with on a daily basis was developed in part by Dartmouth and other affiliates, and I cannot think of a better place to advance my education.

I was introduced to CFD in my junior year at the University of New Hampshire (UNH) through an introductory course. After learning about various discretization schemes, solution methods, and turbulence modeling, I was introduced to OpenFOAM, creating toy simulations that demonstrated convection, diffusion, and other physical phenomena. Following this course, I was able to apply what I learned at DEKA R&D as an intern, primarily focused on modeling flow through deformed IV tubes. This employed a form of naïve fluid-structure interaction, where a separate finite element analysis package modeled hyperelastic deformation of the IV tubes, which were exported to OpenFOAM for CFD analysis. Having seen the utility of engineering simulation first-hand in performing root cause analysis and iterative design, I became incredibly interested in this field.

I then sought out a capstone project that involved CFD, and I became the lead for a research project investigating the trajectory of aerosolized COVID-19 particles in the built environemnt, with a focus on classrooms and methods to mitigate lateral transfer to prevent infection. Under the assumption that aerosols behave as a passive scalar in a flow field, we designed experiments using CO_2 as a passive scalar. This project coincided with the pandemic, and access to classrooms was limited, demonstrating an opportunity to develop a digital twin of the classrooms. This resulted in my first experience with Ansys Workbench and Fluent. CO_2 concentration data from initial experiments served as a reference for me to develop an initial model while the team organized access to classrooms. As new experiments were performed, the CFD models were refined to serve as a testbed for transfer prevention methods including physical barriers, box fans, and supplemental exhaust systems. This model was critical for rapid prototyping of transfer solutions, reducing time spent setting up experiments and lowering material expenses.

In parallel with my capstone, I took an elective in high-performance computing. This taught me scientific computing with C++, version control with Git, and parallelization with OpenMP and MPI. Given that software engineering was not emphasized in UNH's mechanical engineering curriculum, there was a learning curve to overcome, but as my final project I chose to simulate the 2D lid-driven cavity problem using the SIMPLE algorithm to connect the course to CFD.

Prior to graduation, I was offered a position at DEKA R&D as a mechanical engineer to continue working on the same project as my internship. However, I had spent two weeks in Iceland for a brief sustainability study abroad program, and I was inspired by their pervasive use of renewable energy. Having attended lectures at Reykjavik University during this program, I decided to enroll and pursue a Master's degree in Sustainable Energy Engineering, in hopes of contributing to the clean energy transition stateside. While I had no issues academically, my mental health suffered, resulting in my return after one semester. Regardless, I continue to have a strong interest in sustainability, and I hope to apply engineering analysis to renewable energy systems in the future.

Having been born and raised in Lebanon, Dartmouth has been a constant presence in my life, with my grandmother having served as the ski team's secretary, and my father being an alumnus. Due to this, attending Dartmouth has been a bit of a dream for me, and I would be ecstatic to continue this legacy for another generation.

Thank you for your time and consideration, and I look forward to your response!

Yours Faithfully,

Davis Cole