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In a world of increasing technological sophistication, the challenges facing society aresimilarly becoming more complex.

Many of today’s challenges require intelligent engineeringsolutions to improve mankind’s quality of life while also being respectful of the earth’sresources. To put myself in the best position to help create these solutions, I feel it is imperativefor me to pursue a doctorate degree. By continuing my education, I hope to expand myknowledge base and gain laboratory experience so that I may continue to grow as a student, mentor, researcher, and engineer. I began my undergraduate research in Summer 2016 in the Barton Research Group underProf. Kira Barton at the University of Michigan. When I joined the lab, I hoped to use conceptsfrom my coursework in real-world situations, but quickly found that research demands muchmore than what is taught in the classroom. Rather, it requires strong researchers to be activelearners and creative problem solvers.

Prof. Barton has helped me grow tremendously in thisregard by allowing me to work on challenging projects that align with my educational interests. It was in this environment that my enthusiasm for research blossomed, and I am excited to comeinto lab every day ready to learn something new. I have experienced excellent mentorship in boththe lab and the classroom, and understand the incredible impact that a teacher can have on thedevelopment of a student. As such, I hope to attain a doctoral degree to help achieve my longtermgoal of becoming a university professor.

A professorship would allow me to not onlycontribute to new research, but also give me the opportunity to positively impact the nextgeneration of

students. I am confident that under the guidance of the exceptional faculty at YaleUniversity, I will be well placed to pursue my goals in the world of academia. For my first project in the lab, I was tasked with developing an electrohydrodynamic-jet(e-jet) printer to aid investigations of printing behavior under various environmental conditions. To accomplish this, I taught myself Python and designed firmware and software to allowcommunication with an Arduino microcontroller and control the motion and actuation of theprinter.

The successful completion of this project was pivotal for my growth, as I learned how toquickly develop a new skill and use it towards a practical application. Following this assignment, I began generating numerical simulations of the e-jet printingprocess to expedite experimentation. With no previous experience in Computational FluidDynamics, I learned how to run simulations using Ansys Fluent and OpenFOAM which enabledmore effective characterization of the printing behavior of various ‘ inks’. From this work Iprepared a conference paper for the Annual International Solid Freeform Fabrication (SFF)Symposium in August 2017 hosted by the University of Texas at Austin. Additionally, as part ofthe SFF Symposium, I delivered an oral presentation, and provided manuscript reviews to otherresearchers in the field of additive manufacturing. This experience was incredibly rewarding, andmade me realize the pressing need for investigators to solve problems that are constantlyevolving as technology continues to expand.

I returned to the Barton Research Group in Fall 2017 to continue this research which, inconjunction with work done by a graduate mentor, will

culminate in a manuscript intended forpublication in 2018. Additionally, I am developing methods for manufacturing with liquidgallium using e-jet printing techniques. I have constructed a system that will be used to characterize the behavior of the liquid metal and help me gain experience conductingexperiments on a physical system.

The results of these experiments will be presented at anundergraduate symposium in April 2018. While most of my research experience has involved fluid system analysis, I am primarilyinterested in control system engineering. I was first introduced to the field of controls by amechanical engineering design course where I created a mechanism that utilized an Arduino toimplement PID control on the device’s position. Later, from electrical engineering classes insignal processing and control system analysis, I developed a deeper appreciation for the theorybehind system identification and controller design. Additionally, an embedded systems coursehas given me hands-on experience from programming a Freescale microcontroller to implementfeedback control of a haptic device.

These classes have been pivotal in enhancing my interestand understanding of control engineering. What appeals to me most about control engineering is its broad applicability. Fromrobotics and manufacturing, to the energy and biomedical fields, control engineering is aninvaluable tool for design and process optimization. In Prof. Madhusudhan Venkadesan’sBiomechanics and Control Lab, for example, they are investigating the role that elastic energystorage plays in enabling accurate throwing. These findings are significant as they can help guidephysical rehabilitation techniques and

robotic design. Meanwhile, research done by Prof. AaronDollar’s GRAB Lab into model predictive control techniques has allowed for improvedmanipulation of objects using underactuated grippers.

This work will enable more robust controlof robotic grasping devices which are becoming increasingly important as the field of advancedmanufacturing expands. The amount of impactful controls research being conducted within theDepartment of Mechanical Engineering and Materials Science is vast, and as society pushes formore efficient, safe, and cost-effective processes, control engineering will play a crucial role inthe development of new technologies. As such, I am excited to pursue research in this field tohelp tackle challenges facing the world of today and tomorrow. From the recent development of the Center for Engineering Innovation and Design, which promotes interdisciplinary student collaboration and invention, to the creation of the TsaiCenter for Innovative Thinking that will provide a platform for community members from acrossthe university to pioneer new ideas, Yale’s commitment to maintaining its reputation as one ofthe finest educational institutions in the world is clear. It is this emphasis on supporting studentwork, as well as its investment towards producing cutting-edge research, that make YaleUniversity a top choice for me to pursue my graduate education.