Thesis Portfolio

Computational Fluid Dynamics Simulation of Impeller and Seal Rotordynamics
(Technical Report)

CAD Usage in Modern Engineering and Effects on the Design Process
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering and Applied Science

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Spring, 2021

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Sociotechnical Synthesis

The focus of my technical project has been on simulating rotating machinery components using a CAD software program, ANSYS, in the Rotating Machinery and Controls (ROMAC) laboratory at the University of Virginia. This research has been conducted under the guidance of Dr. Cori Watson-Kassa, Research Scientist. The aim of the work has been to validate the results of CFD simulations on impellers and smooth seals against existing experimental data, with the hope of additionally identifying techniques to improve the performance of such pieces in turbomachinery. Validation of CFD software against experimental tests could in future cut costs of testing geometries for impellers and seals, and lead to the development of improved, more efficient machinery.

This technical research has been entirely conducted using a CAD program to simulate physical models and experiments. The goal of the research is also to allow CFD analysis through CAD programs to become more widespread, as the results are validated and the benefits of a computer program over a physical model are identified and proven. Through my STS research, I was able to investigate how the expansion of CAD in engineering is impacting education, engineering work, and the design process as a whole. This research examines how a virtual environment is affecting how students learn about engineering, and how professional engineers design and interact with their creations. Studies on these interactions and impacts on the design process are vital in the integration of CAD fully into the engineering world, without the creative process or learning experience of engineers being negatively affected.

The technical and STS research tie together in how CAD is used widely in engineering, and how the study of the impacts of it on engineers is vital to improving the field of engineering as a whole. Working only with a computer program to perform CFD analysis in the technical portion revealed to me some of the positives and negatives of CAD software, and introduced me to the idea of researching the consequences and ideas for improvement in the virtual environment of engineering design in the 21st century.

I'd like to thank my technical research advisor, Dr. Cori Watson-Kassa, for assisting me with this research since Summer 2019. I learned everything I know about turbomachinery and CFD analysis under her guidance in the ROMAC laboratory. I'd also like to thank Professor Ferguson, for assisting with the STS research portion of this thesis throughout my 4th year at UVA.