Web Summary

Computational Modeling of a High Frequency Pulse Tube Cryocooler for Performance in Microgravity Conditions from 4-80 Kelvin.

Virginia M. Bigelow
Advisor: LTC Ryan P. Taylor

The study of Pulse Tube Cryocoolers (PTC's) is still a relatively new field. However, benefits such as a decrease in vibration and a longer life due to the introduction of a gas piston have made the PTC a much more attractive and viable option over other cryocoolers. In addition, PTC's have a wide range of applications in space, medical, military, and for superconductors. Within the span of its existence, many studies, both computational and experimental, have been conducted in order to optimize its components and operating conditions. However, most computational studies have sought to optimize the PTC by using a limited set of operating conditions while expansively studying the complex losses.

This aim of this thesis is to fill a gap in the computational studies. This was done by analyzing the performance of the pulse tube component for a large set of operating parameters. These parameters include the size, aspect ratio, pressure ratio, and mass flow rate at the inlet. This project resulted in useful data trends concerning the cooling power and the Figure of Merit of the pulse tube component. In addition, this project served as an extensive basis in which to build meaningful additional studies for the PTC.