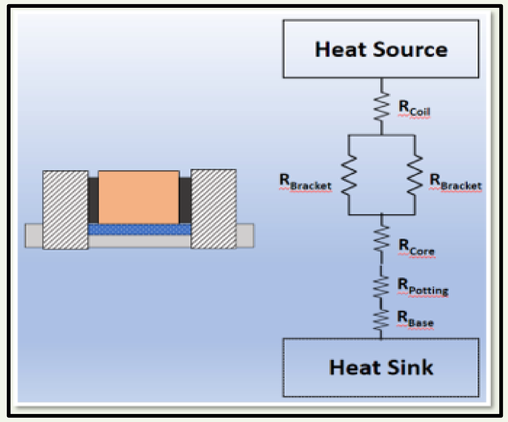
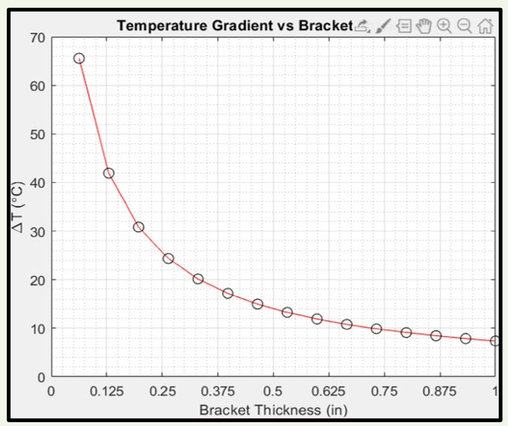
General Electric Magnetics Project
Optimization of Temperature Gradient in Magnetic Inductors

Abstract

This project aims to improve thermal management and power density of the magnetic inductor without significantly increasing the cost and manufacturing time. The results of the project will be in the form of both software analysis and physical tests. Software analysis will be used during rapid prototyping and physical testing will be completed on a fully manufactured part. Design modifications and material changes will be decided based on the results obtained from both the software analysis and the physical testing, the cost difference, and the manufacturability of the altered designs or materials. The main goal is to develop and deliver a product that is improved and superior to the former version given.

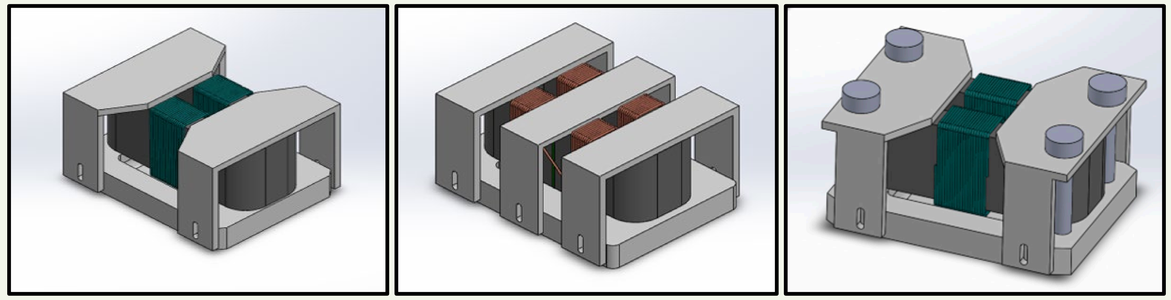
Analytical Modeling



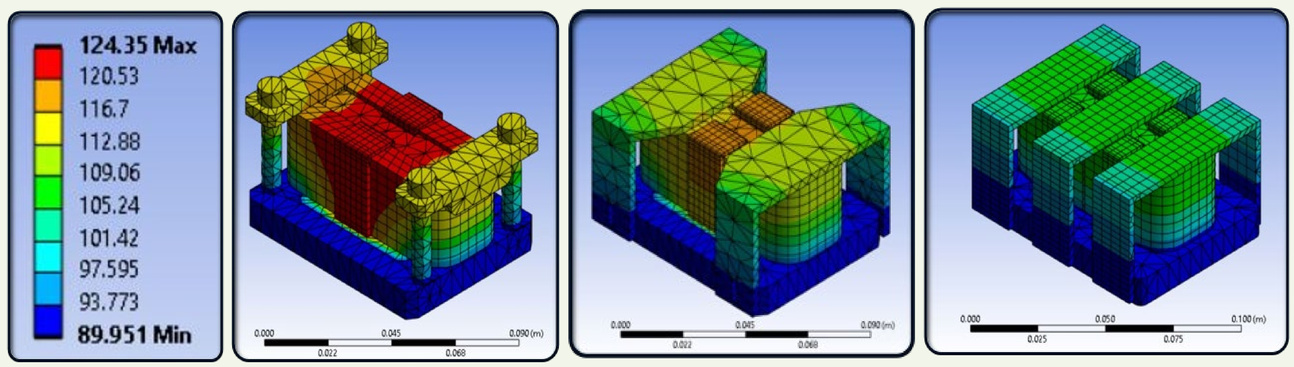


Software Modeling

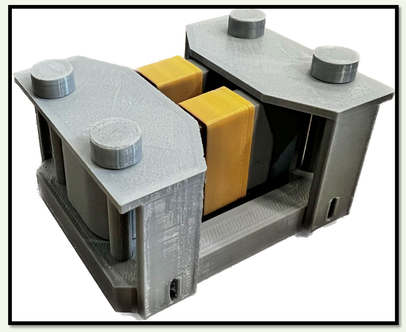
Design Options



Thermal Modeling



Physical Modeling



Results

There were three main aspects to this Design Project: Analytical Modeling, Software Modeling, and Physical Modeling. The Analytical Modeling took advantage of thermodynamic and heat transfer concepts. Equations were derived to find temperature gradients through the system as well as overall conductive resistance values for each component of heat flow. The Software Modeling provided very detailed graphics depicting the temperature gradients in the system. The original design can be seen on the far left showing large hot spots and a large maximum temperature. Moving to the left, the temperature gradients begin to even out as our design iterations progressed. Finally, the Physical Modeling is currently taking place at GE Aviation. Test parameters have been set and the thermal testing is scheduled to verify our findings from the Analytical and Software Modeling.

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