

General Audience Abstract
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Between 2010 and 2020, US consumer demand for electric vehicles (EVs) in the form of annual sales increased by nearly 20000%. This increase in demand has led to significant research into improving electric vehicle efficiency. Minimizing the amount of wasted energy in electric vehicles is critical to maximizing the distance that the vehicle can travel before needing to be recharged. The Advanced Power Electronics and Electric Machines group at NREL is researching ways to improve the efficiency of EVs by focusing on the internal components responsible for distributing electricity throughout the vehicle. One of the most important of these components is the EV inverter, which converts the direct current electricity from the batteries into alternating current electricity used by the vehicle's high-power induction motors.

My SULI project focused on creating a new, multi-layer EV power inverter with improved efficiency compared to the current standard. Typical EV inverters are limited to two-dimensional designs because of their ceramic circuit board material. This greatly increases the overall module area thus increasing the amount of harmful electromagnetic interference in the circuit. This interference slows down the rate at which the inverter can operate, increasing the amount of energy lost as heat. My new inverter module utilizes a flexible insulating material which allows for the layers to be stacked. This stacking reduces the total surface area of the module, thus reducing the electromagnetic interference and improving overall module performance.

As a SULI at NREL this summer I became much more familiar with the computer programming language, Python, and using computer science principles to control and automate an experimental apparatus. I also gained many valuable engineering skills such as working with computer-controlled milling machines and 3D printers. This internship showed me many ways in which engineering skills can be directly applied to support novel research projects. As a result of this work, I can see myself pursuing a career in mechanical engineering where I can assist in the research and development of new technologies.