A Low-Cost Experiment Setup for Quantifying Thermal Conductivity in Solid Objects

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Additive manufacturing (3-D printing) of internal combustion engine parts fabricated from metal alloys offer the promise of opening new possibilities in the field of manufacturing. Here, there is a need for a detailed characterization of the material properties (e.g., thermal conductivity) of metal alloys for developing advanced heat transfer models on engines. This project aims to measure the thermal conductivity of a 3D printed metal component (dog bone shaped), in a low-cost, custom designed experiment setup. Our experiment setup is comprised of a heat source, heat sink, thermal insulation, thermocouples, and an opensource data acquisition electronic hardware (Arduino). To quantify the thermal conductivity, we employed the Fourier heat conduction equation for solids in steady state conditions. Given that our experiment setup has some heat leakage pathways, the estimated thermal conductivity values are outside the range of expected values O(102) W/m-K – necessitating modifications to our experiment setup.