**Project #**

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**Title: Effect of infill parameters on spatiotemporal temperature distribution in fused deposition modeling**

**Abstract:**

Three-dimensional (3D) printing has grown into a widely used technology for consumer and industrial use. Most commercial 3D printers use fused deposition modeling (FDM), a printing technique where a solid thermoplastic filament is repeatedly melted and extruded onto a two-dimensional layer to produce a 3D object. In FDM printing, thermal stresses between layers due to variable thermal conduction during cycles of heating and cooling creates distortions, known as warpage. Various parameters, especially infill pattern and infill percentage, cause thermal properties to become anisotropic because of thermal conduction through plastic, natural convection in air gaps, and the discontinuous nature of plastic. The effect of infill percentage on spatiotemporal temperature distribution and on thermal conductivity was investigated, and a strong, positive association was hypothesized between infill percentage and thermal conductivity due to plastic’s more effective means of heat transfer of plastic when compared to air. Polylactic Acid (PLA) discs of 10%, 20%, 30%, 40%, and 50% infills were printed, and their thermal conductivities were measured using a Lees’ Disc Apparatus. Spatiotemporal temperature data was collected by embedding negative temperature coefficient thermistors. A One-Way ANOVA test was used for comparing thermal conductivities across infill percentages. Temperature gradients between every point and thermal centroids between every point were calculated for all times and used to analyze the change in direction and magnitude of an average heat flow vector over time.