Simulation of Powder Spreading for Metal Additive Manufacturing

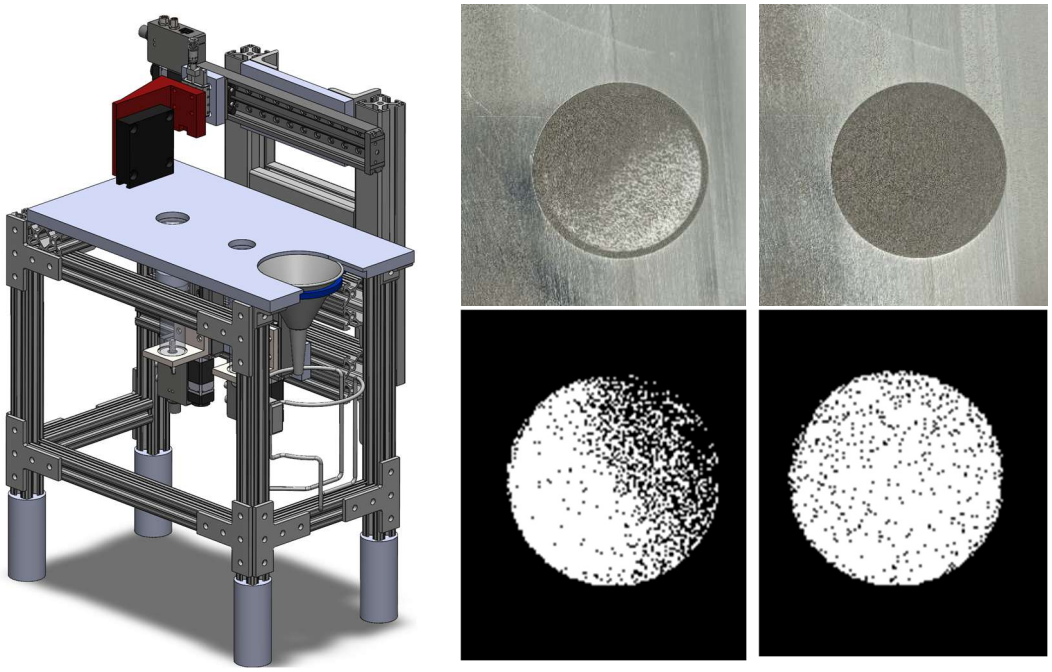
A Master's Thesis Defense in Mechanical Engineering

Presented by: Florence Duff

Committee Members: Dr. Kim Shollenberger (Chair, ME), Dr. Xuan Wang (IME), Steven Hoover (Lawrence Livermore National Laboratory)

Date & Time: Friday June 5th, 9:10-10:00 AM

Location: Building 13 Room 109



The powder recoating process for Laser Powder Bed Fusion requires iterative experimentation to develop the correct process parameters that will result in high quality parts. There currently lacks good spread quality metrics and models for optimizing spread quality. A machine that simulates the powder spreading process was built to streamline the process of selecting process parameters for specific types of powders without having to operate the full laser system. The parameters investigated were the layer thickness and spreading speed. The response variables were metrics developed to assess spread quality: the percentage of the build plate covered by powder and the percentage of the build plate area with defects. Using image analysis methods, the study found that for 316L, the layer thickness has a strong influence over the spread quality compared to spreading speed. The machine was effective at producing consistent powder spreads, and with further development and more testing it can provide insights into the interactions of powder spreading process parameters for any materials of interest as well as alternative recoater designs.