

Proposed Project for MECH 493: Introduction to Academic Research

Laser-Based Additive Manufacturing of Metal Components: System Integration and Experimental Studies

Background: Additive manufacturing (AM) or 3-D printing has been the new thrust in the manufacturing of metallic components with complex geometries. Current technology development in laser additive manufacturing has enabled the fabrication of functional components in various key industrial sectors, such as remanufacturing of impeller blades in aero-engine and manufacturing of dies and molds with complex internal cooling channels for the automotive industry.

Project Description: This project will focus on the system integration of a laser-based AM system and the subsequent experimental evaluation of the AM process performance. Figure 1 shows the current sub-systems of the AM machine, including the machine structure and material deposition head (Figure 1a), metal powder delivery system (Figure 1b), and machine control system (Figure 1c). The student will integrate the mechanical and electronic components and develop the control system to make the AM system operational, considering the necessary safety measures. Also, the student will implement a PC-based control for the machine trajectory generation, motion control, laser power control, and powder delivery. This will enable the AM system to deposit metal powders layer-by-layer to fabricate metal components with designed geometry. When the AM system is operational, the student will test the AM operation with stainless steel powders and investigate the effects of process parameters (e.g., laser power, powder delivery rate, deposition trajectory, etc.) on the mechanical properties and defects of the manufactured component. Students who have backgrounds in Mechatronics and are interested in the Manufacturing area are encouraged to apply for this project.

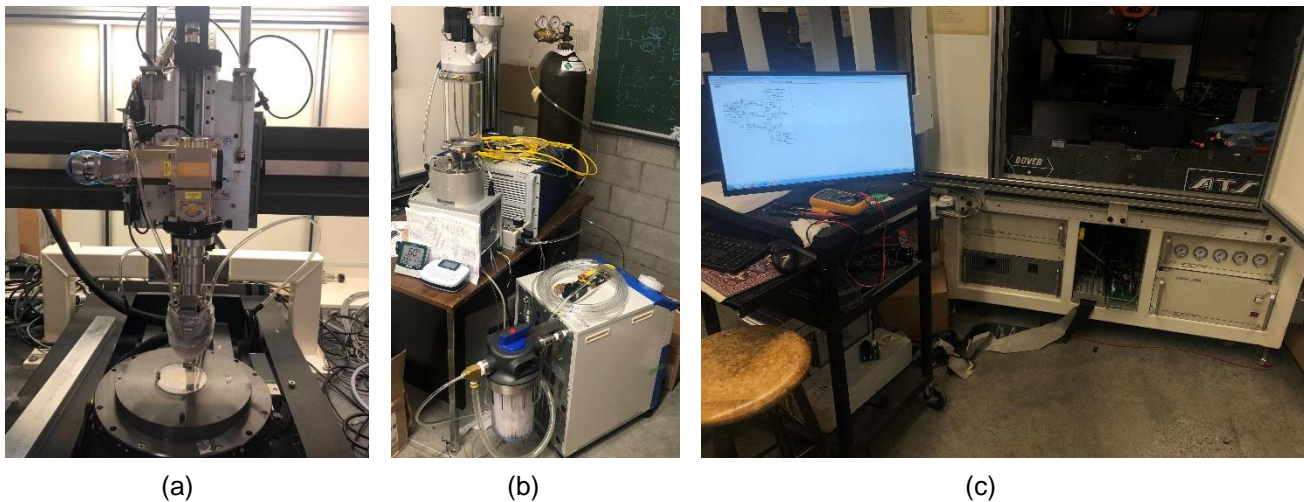


Figure 1 Sub-systems of an Existing Laser-Based Additive Manufacturing Machine

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