Fabrication of Maraging steel thin-walled structures using laser powder bed fusion process

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Abstract-
This paper examines the geometric and microstructural properties of thin-walled metal structures (<1mm) fabricated using laser-based powder fusion (LBPF) for lightweight applications. In the LBPF process, contour and hatch are key parameters that usually differ but may overlap in thin-walled samples, potentially altering their characteristics. This study fabricated twelve samples with thicknesses of 0.3 mm, 0.6 mm, and 0.9 mm using the LPBF process, with six samples printed along the length and six along the width. Mechanical testing, including tensile and hardness tests, and microstructural characterization using optical and BT-SEM imaging were conducted. Horizontally printed samples (width orientation) exhibited higher stress values than vertically printed samples (length orientation), highlighting the impact of build orientation on strength. Hardness tests showed higher HV values in the contour region than the infill, with 0.3 mm samples displaying nearly constant HV values due to contour and infill overlap. Optical images revealed porosity, micro-cracks, unsintered powder, and martensitic lath formation. The study concluded that thickness variation significantly affects the properties of components fabricated using the LPBF process.