Graduate Student Research Seminar

Spring 2022

Microstructural Control Using Alternative Beam Strategies in Metal Additive Manufacturing

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Monday, February 7th
3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

In metal additive manufacturing (AM), the thermal profiles that arise due to the moving laser beam greatly influence materials structure-property-performance linkages. Recent advances in laser-powder-bed-fusion (LPBF) have revealed considerable variations in materials microstructures (i.e., G-R solidification morphology maps) as a function of the AM laser beam profile. Such observations suggest the use of laser beam shape as a strategy to control local temperature gradients. However, a fundamental understanding of how laser beam shapes influence the formation and evolution of solidification microstructures is lacking. Here, we present theoretical and computational studies exploring the impact of laser beam profiles on the local temperature gradients and microstructures. Several laser beam profiles are explored, including Gaussian rings and shifted rings, and the results are compared with those from the commonly used Gaussian beam profile. Broadly speaking, our approach provides an avenue to employ microstructure-based models to explore mesoscale phenomena during AM.

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