

Graduate Student Research Seminar

Fall 2022

Additive manufacturing beyond the Gaussian beam: Insights from mesoscale modeling studies

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Monday, October 3rd

3:00 pm (EST) – 132 Fluor Daniel Building



Abstract

In laser-powder-bed-fusion additive manufacturing (LPBF AM), the microstructures that form are sensitive to the AM process parameters. Recent studies have explored laser beam types beyond the commonly used Gaussian beam in LPBF. However, the impact of beam shape on the evolution of temperature fields and its spatial gradients and the net effect on microstructure development remains poorly understood. Based on a recently developed mesoscale model that accounts for thermal transport and microstructure formation during AM, we explore the evolution of temperature fields and grain microstructures during LPBF using ring and Bessel beams. Sensitivity analysis of the parameters controlling the beam type will be presented. It is shown that changing the laser beam shape results in large variations in the spatial distribution of temperature fields and resulting microstructures. Broadly speaking, our work will expand the parameter space for microstructural design during AM to include laser beam profiles.



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