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# Melt-track merging and instabilities in multi-laser powder bed fusion

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## Abstract

Control over laser beam shape can enable precision control over the resulting materials properties in any laser processing application. One simply way to control the intensity profile of the material illumination is through the use of multiple laser sources or beamlets. However the use of multiple beams can introduce unexpected phenomena and instabilities that can create undesired effects in the material. In this work, we use synchronized laser beams to create two molten pools running parallel to each other in a powder bed fusion system where the beams are separated by a controlled spatial and temporal offset. Through varying the offset, results reveal that besides the completely merged and completely separated regimes, there exists a third regime in which periodic coalescence occurs between the two molten pools. We examine the instability that leads to this periodic structure as well as how to control its formation.

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