Application of mathematical search algorithms for unknown material properties in Additive Manufacturing simulations

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Abstract

Additive manufacturing (AM) simulations have risen as a way to better understand the effect of processing parameters on builds. They are effective for materials which are well characterized and published, however for newer or proprietary materials, they cannot provide accurate results due to the lack of knowledge of material properties. This work demonstrates the process of the application of mathematical search algorithms to develop an optimized material dataset which results in accurate simulations. This was done with 7000 series aluminum and the laser directed energy deposition (DED) process. The Nelder-Mead search algorithm was able to develop an optimized dataset which had a combined width and depth error of just 9.1%. This optimization started from a generic aluminum material properties dataset found in the literature which had an initial error of 600%.

Keywords: Additive manufacturing (AM), Mathematical modeling, Mathematical search, Material properties, Aluminum

Declarations

Financial interests: All authors declare they have no financial interests.
Data Availability: All data generated or analyzed during this study are included in this published article.