Experimental Validation of a Thermo-Mechanical Process Simulation Tool for Laser Powder Bed Fusion Processes

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ABSTRACT

Despite the global efforts and achievements over the last decade to improve the quality of the parts produced by Laser Powder Bed Fusion (LPBF) Additive Manufacturing processes, there are still challenges to overcome before a more significant take-up of these technologies in industrial applications occurs. More specifically, part distortion and cracking due to residual stresses resulting from the unique thermal cycles of LPBF are amongst some of the most significant problems encountered.

Simulation tools have been proven to provide insights about the thermal distortion induced geometrical effects in 3D printed parts by means of the Finite Element (FE) method. In order to find a compromise between computational cost and accuracy, an enhanced inherent strain method has been developed [1] and applied in industrial case studies. This method relies on background temperature data given by thermal simulations which can be validated accordingly [2].

In the present work, the different results and validation tasks to support this simulation methodology are presented, including the in-process background temperature build-up predictions compared against *in-situ* monitoring experimental data by infrared readings. This shows that this simulation scheme can supply realistic results for industrial parts in an affordable timeframe.

REFERENCES

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[2] Flood and Liou. “Review of AM Simulation Validation Techniques”, *2017 Annual International Solid Freeform Fabrication Symposium – An Additive Manufacturing Conference*. Austin. Aug. 2017.