Model Reduction in the Context of Powder Bed Based Additive Manufacturing

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ABSTRACT

Selective electron beam melting (SEBM) represents a powder bed based additive manufacturing technique which is characterised by a layer wise built of complex parts using metal powder material. Thereby an electron beam is utilised to fuse the powder in locally restricted areas, while repeating this procedure in a layer-by-layer fashion enables to realise complex part geometries.

The resulting mesostructure of an additively manufactured part is highly influenced by the process parameters, e.g. beam power and deflection speed. In order to permit the prediction of said structure, Finite Element based temperature fields may be combined with grain growth simulation tools based on Cellular Automata to simulate the resulting mesostructure.

In this contribution projection based Model Reduction techniques suited for non-symmetric problems are utilised for the fast prediction of the temperature field arising in SEBM [1]. This includes the Proper Orthogonal Decomposition, an appropriate treatment of nonlinearities [2, 3] as well as accuracy and robustness considerations. The simulated temperature field is then used as an input for the grain growth simulation tool.

REFERENCES

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