Additive Manufacturing Hybrid Twin

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ABSTRACT

Additive manufacturing is the more and more considered in industry, however efficient simulation tools able to perform accurate predictions are still quite limited. The main difficulties for an efficient simulation are related to the multiple scales, the multiple and complex physics involved, as well as the strong dependency on the process trajectory.

In [1] authors proposed the use of advanced model reduction techniques for performing parametric simulations of additive manufacturing processes, where deposition trajectory, the intensity of the thermal shrinkage and the deposited layers were considered as model parameters. The resulting simulation tool allowed evaluating in real-time the impact of the parameters just referred on the part distortion, and proceed to the required geometrical compensation.

In [2] authors addressed the use of that parametric solution with three different purposes: (i) evaluating the parameters leading to the minimal part distortion; (ii) evaluating the solution sensitivity to the different parameters, and in particular to the ones related to the deposition trajectory; and (iii) propagating the uncertainty related to the intensity of the thermal shrinkage.

In the present work we perform a step forward, by assimilating collected data to create an hybrid-twin of the process [3] combining the physics-based parametric model enriched with a learned-on-the-fly data-driven model enabling real-time process control for anticipating future events, keeping the process under control with respect to the assumed target.

REFERENCES

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