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DIGITAL TWINS FOR ADDITIVE MANUFACTURING

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ABSTRACT

Digital twins are emerging as a cornerstone in many manufacturing environments, for purposes such as monitoring and controlling processes, as well as providing a basis for downstream applications and lifecycle management. As opposed to targeted simulation algorithms, digital twins aim to combine multiple inputs, both physics-based and data-driven, in order to provide a more complete model with broader functionality which can be used for general queries that support decision making [1].

Additive manufacturing in particular gives unique possibilities to create digital twins that model not only the exterior form of an object, but also the inner structures and interior material properties, by capturing data during each layer of the process. Layer-based data can include light-spectrum imagery, thermal data, or more innovative datatypes such as from eddy current sensors. Despite some sensors being able to penetrate several layers into the material, there remain phenomena that are difficult to capture in in-situ data, such as distortions and possible cracking that occur during cooling. Since such cooling occurs mainly after subsequent layers have been deposited, capturing in-situ data that can model the distortions is more difficult as the distorted areas are typically not readily accessible by sensors. Data-driven methods should thus be complemented with physics-based simulation approaches that can model such effects to ensure that the digital twin model does in fact provide a faithful representation of the physical object.

In this Invited Session, we will discuss recent advances in techniques that support the creation of digital twin models in the field of additive manufacturing and how the digital twins can be used in practice.

REFERENCES

[1] Barrowclough, OJD., Briseid, S., Dokken, T., Gavriil, K., Muntingh, G., *Data-driven geometric modelling methods for digital twinning: manufacturing, geospatial and medical applications*. (submitted) 2022.