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ADVANCED DIGITAL TWINS OF COMPOSITE MATERIALS AND MANUFACTURING PROCESSES

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ABSTRACT

Modeling and simulation of composite materials' behavior, and their advanced manufacturing processes (3D printing, injection molding, resin transfer molding, etc.) often involve complex and coupled physics with little to no available data on the actual material properties under processing conditions. The ignorance associated with the modeling of those processes propagates through the simulation and deviates the digital twin solutions from the reference measurement data [1,2]. Recent developments in the field of composite materials aim to complement the physics-based digital twins' solutions with data-driven approaches, while others intend to refine the models through parameter identification or model augmentations. Real-world uncertainties and variability are also being addressed through different technologies.

The aim of this mini-symposium is to collect and discuss recent developments and advances addressing the build-up of digital twins for composite materials and their transformation processes, as well as models' augmentations using data measurements and in-situ knowledge embedding within closed loops. The main topics of the mini-symposium are, but not limited to, uncertainty propagation, parameter identification for in-situ processes, closed-loop real-time modeling, physical models' augmentation with data, and ignorance characterization in the simulation of composite manufacturing processes (e.g. resin transfer molding, automated fiber placement, etc.).

REFERENCES

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[2] Rodriguez, S., Monteiro, E., Mechbal, N. et al. Hybrid twin of RTM process at the scarce data limit. Int J Mater Form 16, 40 (2023). https://doi.org/10.1007/s12289-023-01747-2.