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DIGITAL TWINS FOR AEROSPACE APPLICATIONS

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ABSTRACT

Digital twins (DTs) - high-fidelity, continuously updated virtual representations of physical systems - are transforming the field of aerospace engineering. This mini-symposium brings together researchers and practitioners to explore ways in which digital twin technologies can improve the design, operation and maintenance of such systems.

We invite contributions that leverage digital twins across a broad spectrum of aerospace applications. Topics may include, but are not limited to:

- **Digital twins for design, testing, and certification** use virtual replicas to speed up the design process, cut down on testing, and facilitate certification via physics-based simulations or hybrid approaches combining physical and efficient AI models.
- **Structural health monitoring and predictive maintenance** leverage digital twins to detect damage, estimate remaining life, and optimize maintenance.
- **Geometric modeling** develops high-fidelity geometric representations as the backbone of aerospace digital twins.
- **Human-in-the-loop systems and decision** support integrate human expertise with digital twins to enhance decision-making and situational awareness.
- **Digital continuity, interoperability, and lifecycle management** establish standards that ensure consistent data flow, compatibility, and maintainability.
- **Fusion of system models, sensor data, and geometric models** to combine physics-based models and real-time sensor data with geometric representations.
- **Cloud-Edge-IoT solutions** for aerospace applications and missions**.**
- **Case studies from industry and large-scale deployments** showcase real-world implementations, benefits, and lessons learned (e.g. mission operation control, mission design, system of systems).

While these examples highlight prominent use cases, the minisymposium encourages submissions on **all aspects of digital twins for aerospace applications**. This includes emerging techniques, cross-domain transferability, and the theoretical approaches of DTs tailored to aerospace systems.

Through this session, we aim to foster interdisciplinary dialogue between the computational mechanics, aerospace engineering, and machine learning communities.