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MANUFACTURING PROCESS MODELING AND THE EFFECTS OF MANUFACTURING ON THE MECHANICAL PERFORMANCE OF COMPOSITES

1000 (MANUFACTURING AND MATERIALS PROCESSING)

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ABSTRACT

Scope description: This mini-symposium is about accounting for the manufacturing effects in the design of composite parts, structures and requirements on semi-products.

Several physical quantities are affected by the manufacturing process of composite components that subsequently influence its mechanical behavior and performance: fiber orientation, porosity, fiber undulation, local fiber content variations, thickness, degree of cure, fibers tow sections modifications, degree of crystallization, degree of intimate contact, surface topology, etc. Moreover these quantities can also have an important impact on the manufacturing steps of the semi product

The state-of-the-art industrial practice to handle the uncertainties associated with these effects is through the use of conservative knock-down factors that can be as large as 50%. This approach leads to oversizing of the composite structural components and results in weight increase and high manufacturing costs. Thus, composite materials cannot be fully exploited to meet the desired and expected benefits. This situation reflects the lack of scientific knowledge, mathematical models, commercial simulation tools and established methodologies in the design of optimally designed composite structures.

In order to rely on numerical simulation to address the effects of manufacturing, it is necessary to have a description of the manufactured parts that includes physical details, to make this information available to the mechanical performance simulation and have material models that can incorporate all the added information in the stress, failure, damage and fatigue simulations.

Manufacturing process simulation, experimental measurements (computer tomography, sensors, etc.) are a source of data to describe the initial semi-products and manufactured part. Transfer of information from manufacturing to design calls for geometrical, physical and mathematical model mapping. Generating local material data resulting from the manufacturing is a challenge in itself and eventually the question arises about developing new material models or using raw data in existing material models.

You are encouraged to submit abstracts on these topics.

Contributions to a holistic composite design approach involving machine learning approaches, data analytics technologies and model reduction are welcome.