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ON THE IMPACT OF ADDITIVE MANUFACTURING PROCESSES ON THE MECHANICAL BEHAVIOR OF LATTICE STRUCTURES

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ABSTRACT

Additive manufacturing techniques offer unprecedented capabilities, particularly in the production of complex geometries. Among these complex geometries, lattice structures, often referred to as meta-materials, are particularly promising for structural and thermal applications due to their ability to maximize the strength-to-weight ratio, improve vibrational/sound insulation, and enhance thermal performance. By meticulously designing the representative volumetric element (RVE) or unit cell (UC), it is virtually possible to achieve endless configurations tailored to specific requirements.

However, the manufacturing techniques employed to produce these intricate structures, such as laser powder bed fusion (L-PBF) and electron beam melting (EBM), can introduce geometric deviations from the ideal designs. These deviations can significantly impact the final performance, affecting both structural integrity and thermal efficiency.

This invited session will focus on the following key areas:

- The influence of geometric deviations on the final structural response, including
    - static, and fatigue performance,
    - energy absorption,
    - thermal behaviour
    - vibrational performance
- Methodologies to improve the manufacturing process of lattice structures, aiming to mitigate the effects of these imperfections and ensure the desired performance are achieved.

By addressing these areas, the session aims to advance the understanding and application of lattice structures in various high-performance fields, maximizing their potential despite the challenges posed by current manufacturing limitations.