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Damping and lightweight properties of 3D metal lattices produced by additive manufacturing

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Selective laser melting (SLM) is one of the most common additive manufacturing (AM) processes for metals. It is based on the local fusion of a powder bed through a laser beam starting from 3D digital models. One of the most important capabilities of SLM is the possibility of realizing complex objects that cannot be manufactured otherwise. This has led to a radical change regarding how parts are conceived, designed and embodied in final products. For instance, AM has enabled the possibility to create lightweight parts by integrating 3D lattice structures. The type of elementary cells and their orientation, the shape and dimension of each lattice beam can be freely designed with the aim of customizing thermal, physical, functional and mechanical response of AM components. By this work, we show the additional possibility of exploiting AM for the production of parts embedding lattice structures to improve their damping capacity. In many applications, a high damping capacity combined with enhanced lightweight properties is indeed a desired target, especially in the transportation sector. SLM was employed to produce 316L stainless steel and Al-7Si-Mg specimens, some of them including 3D lattice structures. The internal friction of lattices was estimated in terms of tanδ and compared with that of the corresponding bulk material for different applied loads and load frequencies. A finite element model and microstructural investigations were performed for a better understanding of the damping results. The investigation was also supported by microstructural and morphological analyses on surface of the lattices in order to provide a better understanding of the damping results obtained.

Biography

M Vedani is a Full Professor of Metallurgy at Politecnico di Milano, Department of Mechanical Engineering. He is Chief of the Materials Section and has wide experience in metallurgy and processing of light and special metallic alloys, with particular attention in recent years to additive manufacturing.

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