Topology Optimization of Dynamic Response: Methods, Materials and Additive Manufacturing (Sim-AM 2019)

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ABSTRACT

Topology optimization of dynamic response is a matter that is engaging practitioners and researchers since a few decades. Issues that have been (at least partially) successively solved include minimization methods, filtering, stress constraints and robustness with respect to load and material uncertainty, among others.

Within this scenario, the Additive Manufacturing technology offers a huge variety of new possibilities as to material properties and overall structures that are designed using topology optimization. On the other side, entirely new challenges emerge that have started being faced only recently by the scientific community that are most times multidisciplinary.

This paper addresses the following two issues:

1. from a mechanical standpoint, the H_∞-norm-based approach developed in [1] is extended to improve printability of the optimal design. This is achieved by adopting an extended formulation that explicitly includes a constraint on the maximum allowable overhang of the optimal topology;
2. newly conceived composite materials are considered such as those recently proposed in [2] and [3]. It is to be noted that chemical research is in fact providing new materials for novel applications nearly every day. As for mechanical properties of the composite, fibers are traditionally deposited along a pre-selected direction [3] and the resulting overall mechanical modulus computed as a convex combination of the matrix and fibers moduli. It is planned to exploit the effect of using fibers of variable orientation so as to end up with and increased stiffness at the overall structural level.

A numerical application on a benchmark problem (the MMB beam) shall be addressed and the optimal numerical solution computed. An insight into the actual manufacturability of the numerical model will be given as well along with preliminary experimental results.

REFERENCES

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