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Topology optimization of viscoelastic materials considering additive manufacturing

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Extended Abstract

Although rubber materials are essential in various engineering fields as cushioning and energy absorbi ng materials, their performance has not changed significantly in the past 20 years. In recent years, the introduction of a new technology called additive manufacturing has opened the possibility of finding su perior performance that could not be obtained with conventional rubber products. In particular, the development of additive manufacturing technology using multiple rubber materials is underway, and if this becomes possible, it will have a significant social impact. However, it is not easy to find the optimum geometry of multiple materials for a given purpose by an empirical method.

In this study, we focus on energy absorption performance, which is a typical function of rubber, and develop a multi-material topology optimization method that considers dynamic viscoelastic mechanical behavior to maximize the performance. A gradient-based topology optimization scheme is used for this problem and the variational adjoint sensitivity method is proposed. The proposed method is verified by a series of numerical examples.