6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

TOPOLOGY OPTIMIZATION OF ELASTOMER DAMPING DEVICES FOR STRUCTURAL VIBRATION REDUCTION

S. Burri[1], A. Legay[1] and J-F. Deü[1]

[1]LMSSC, Conservatoire National des Arts et Métiers,
Case courrier 2D6R10, 2 rue conté 75013 Paris, France
{sylvain.burri, antoine.legay, jean-francois.deu}@lecnam.net

Keywords: *Topology Optimization, Vibration Damping, Numerical Methods, Viscoelastic Material*

Thanks to their damping properties, elastomer materials are commonly used in aeronautics and aerospace industry in order to manufacturate damping devices, especially in terms of joints between sub-systems of mechanical assembling. In aeronautics, these damping joints can be used to protect electrical or optical on-board equipments from external noise and vibration sources. These joints should then deal with two contradictory aims : transmitting static loads and damping vibrations. The purpose of this work is to develop a topology optimization tool for rubber devices.

The first part of this work consists in developping a topology optimization code based on SIMP method, with a static criteria allowing us to minimize external forces work (corresponding to a stiffness maximization), while constraining the final solution to a maximum amount of material. This house code is developped for any geometry (in 1D, 2D or 3D) and mesh, and for any boundary conditions in terms of force and displacement.

The second part of this study aims at modifying the optimization criteria in order to minimize, dynamically, the structural displacement amplitude at a given frequency or on a frequency range. For that purpose, several numerical methods for optimum reaching are studied and adapted to vibration reduction problems.

Finally, a practical application is introduced. It consists in a structure which stands on elastomer joints submitted to a vibrating excitation on their bases. Due to the difference in terms of material stiffness between structure and joints, interfaces are considered as rigid bodies. The aim is to optimize the shape of joints for the purpose of minimizing vibrations of the structure.

REFERENCES

[1] M.P. Bendsoe and O. Sigmund *Topology optimization*. Springer, 2004.

[2] K. Svanberg, *The Method of Moving Asymptotes - Modelling aspects and solution schemes*, Lecture notes, 1998.

[3] B. Morin, A. Legay and J.-F. Deü *Reduced order models for dynamic behavior of elastomer damping devices*, Finite Elements in Analysis and Design, submitted, 2018