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A numerical method to fit the need of a straightforward characterization of viscoelastic materials for marine applications

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In the field of green shipping the reduction of acoustic noise partially transmitted into water and the need of guarantee high comfort levels are important aspects in the view to agree with the UN 2030 Agenda in respect to life below water and good health and well-being. Both these aspects imply actions to increase absorption and dissipation of vibrational energy radiated towards the hull. To accomplish this effect, viscoelastic materials (VEM) characterized by high levels of damping are commonly used onboard ships (J. Fragasso et al., 2017, R. Kandasamy et al., 2016). In the last times, new strict requirements led to the development of Isocyanate free VEM, so the necessity of a provisional method to investigate in an efficient way new VEM is required.
Experimental tests are essential in order to obtain performance indicators (non-standard procedure) or material physical characteristics (Oberst's beam test, ASTM E756 – 05). The implementation of the usual experimental setup could result rather complicated and it needs a high degree of accuracy, so in the last times finite element methods (FEM) has been increasingly used (Huang et al., 2020), even with the proposal of new element architectures. Knowing VEM physics parameters allows numerical simulation in both the provisional and the optimization phase to be accurate and reliable.
In this paper, an experimental-numerical method is proposed, with the aim of overtake the issues linked to the small-scale traditional cantilever beam test and paving the way to the selection of the most appropriate shape of the specimen. The innovation proposed through this method lies in the evaluation of the VEM complex modulus based on a reverse engineering approach, in which the loss factor estimation, contrarily from the traditional methods, is free from peak sharpness dependence. The proposed procedure is validated by comparison with the traditional method.

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