Damping of flexural waves with imbedded viscoelastic materials

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Abstract: This paper considers a passive damping method that can be applied to beam-like structures such as machine tool bases and columns. The method uses viscoelastic materials to dissipate energy in the manner of classic constrained-layer damping; however, the layers are embedded within the structure as opposed to being applied externally. This provides a robust means of incorporating damping without encountering several of the common disadvantages associated with external damping treatments. An analytical solution to the amount of damping that can be achieved using embedded layers is available, but is known to be inaccurate when the viscoelastic stiffness approaches that of the structural components. Therefore, a new prediction of the maximum damping level that can be expected in a structure is developed and presented here. This prediction gives good results in a wide variety of applications, and offers insight into the relationship between key design parameters. Finite element and experimental verification of the maximum damping predictor are also presented. (13 refs.) (Author abstract)