COMPUTER MODELLING OF THE DYNAMIC RESPONSE OF VISCOELASTIC VIBROISOLATORS

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The paper investigates ways to model the response of vibro-isolation mounts that utilise viscoelastic materials. Simple models based on linear and nonlinear static stiffness are developed. Dynamic response is approximated through appropriate scaling of the viscoelastic Young's modulus and use of the measured material loss factor. The approach is validated using cylindrical mounts made of polyurethane. The response of a 68 kg mass supported by two mounts and subjected to two different high-amplitude shock loads is predicted. Measured and predicted behaviour correlate closely for the nonlinear model while the linear model gives a reasonable representation. It is noted that the sensitivity of such mounts to temperature is high: the change in response associated with a temperature excursion of 10 °C is significantly greater than the inaccuracy involved with using the linear model.

Key words: *computer modelling, viscoelastic materials, shock-vibration loading, dynamic response*

1. Introduction

Shock mounts made of viscoelastic materials are often used to protect equipment from excessive accelerations. In naval applications for example, viscoelastic mounts support sensitive electronic equipment and their effectiveness in reducing blast-induced acceleration is an important factor in overall warship survivability. The ability to predict the behaviour of shock mounts under high severity shock loads is an important design capability: acceleration levels are needed to specify equipment ruggedness while the displacement envelope defines the sway/rattle spaces needed.

There has been significant activity in the naval shock community to develop appropriate modelling methods [1–7]. A series of studies have been carried out to establish guidelines for Finite Element (FE) method for predicting large static [8, 9] and dynamic [1, 5] deformations (up to 70 % length change in cylindrical viscoelastic mounts). The disadvantage of FE approach is that it places high demands on computer time and memory. At the early concept design stages, when many different options are being considered, an accurate but numerically more efficient method is needed.

The aim of the work presented here was to develop a prediction capability based on simple models that could, with reasonable accuracy, predict the large shock response of an equipment and shock mount system. For each mount, the approach used was to model the mount stiffness using a nonlinear spring and to represent the damping using an equivalent

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