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Mechanical vibration and shock — Characterization of the dynamic mechanical properties of visco-elastic materials —

Part 6: Time-temperature superposition

Vibrations et chocs mécaniques — Caractérisation des propriétés mécaniques dynamiques des matériaux visco-élastiques —

Partie 6: Superposition du temps et de la température

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Foreword

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This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*.

A list of all parts in the ISO 18437 series can be found on the ISO website.

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Introduction

Visco-elastic materials are used extensively to reduce vibration amplitudes in structural systems through dissipation of energy (damping) or isolation of components and in acoustical applications that require a modification of the reflection, transmission or absorption of energy. The design, modelling and characterization of such systems often require specific dynamic mechanical properties in order to function in an optimum manner. For most visco-elastic materials, these properties depend on frequency, temperature and amplitude of applied excitation. The aim of this document is to provide details on the best way of data acquisition for subsequent processing and to provide a standard method for analysis using the time-temperature superposition principle. This document applies to the linear behaviour observed at small strain (stress) amplitudes and to thermorheologically simple materials.

This document presents a method for checking the validity of a thermorheological simplicity of a material and for identifying and eliminating questionable data. It provides minimal criteria for data acquisition to be applied in mathematical methodologies, which allow multiple data sets of dynamic visco-elastic properties measured at different temperatures to be cast into a single master curve according to the time-temperature superposition (TTS) principle. When sufficient data are obtained or available, a standard method, which uses a closed form shifting algorithm[16][17], is defined.

TTS is the most widely-used method for accelerated prediction of long-term visco-elastic behaviour of materials[13]. In the frequency domain, TTS can be used for predicting the behaviour of materials at frequencies that are experimentally not assessable.

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