

ICS 17.160
CCS Z 32



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 45159.5-2025

**Mechanical vibration and shock - Characterization of the dynamic mechanical
properties of visco-elastic materials - Part 5: Poisson ratio based on comparison
between measurements and finite element analysis**

(English Translation)

Issued on: August 1, 2025

Implemented on: November 1, 2025

**Issued by: State Administration for Market Regulation, Standardization
Administration of China**

Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative references	
3 Terms and Definitions	
4 Measurement Principle	
5 Single sample measurement method	
5.1 Overview	
5.2 Basic Theory	
5.3 Sample geometry and frequency range	
5.4 Stiffness Measurement	
5.5 Data Collection	
6 Two-sample measurement method	
6.1 Overview	
6.2 Basic Theory	
6.3 Determination of Poisson's ratio	
6.4 Specimen geometry and frequency range	
7 Test Equipment	
8 Sample preparation and installation	
9 Sample conditioning	
10 Main sources of uncertainty	10
11 Time and temperature superposition	
Appendix A (Informative) Linear Characteristics of Resilient Materials	
Reference	

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is Part 5 of GB/T 45159 "Characterization of dynamic mechanical properties of viscoelastic materials subject to mechanical vibration and shock".

GB/T 45159 has published the following parts.

- Part 1: Principles and guidelines;
- Part 2: Resonance method;
- Part 3: Cantilever shear beam method;
- Part 4: Dynamic stiffness method;
- Part 5: Poisson's ratio based on comparison of measurement and finite element analysis;
- Part 6: Time-temperature superposition.

This document is equivalent to ISO 18437-5:2011 "Mechanical vibration and shock - Characterization of dynamic mechanical properties of viscoelastic materials - Part 5 Poisson's ratio based on comparison of measurement and finite element analysis.

Introduction

GB/T 45159 provides three methods for measuring the elastic modulus and loss factor of viscoelastic materials, and two methods for measuring Poisson's ratio.

The operating principle, measuring device, measurement and data analysis of the method are presented, thus providing a measurement method for characterizing the dynamic mechanical properties of viscoelastic materials.

It consists of 6 parts.

--- Part 1: Principles and guidance. The purpose is to describe three methods for measuring the elastic modulus and loss factor of viscoelastic materials, and Two methods for measuring Poisson's ratio are presented, along with the test setup, measurement range, and limitations of each method.

--- Part 2: Resonance method. The purpose is to describe the technical requirements for the resonance method to test the dynamic mechanical properties of viscoelastic materials.

--- Part 3: Cantilever shear beam method. The purpose is to describe the cantilever shear beam method for testing the dynamic mechanical properties of viscoelastic materials.

Technical regulations.

--- Part 4: Dynamic stiffness method. The purpose is to describe the technical requirements for the dynamic mechanical properties characterization of viscoelastic materials using the dynamic stiffness method.

--- Part 5: Poisson's ratio based on comparison of measurement and finite element analysis. The purpose is to describe the Poisson's ratio based on comparison of measurement and finite element analysis.

Poisson's ratio test is a technical provision for characterizing the dynamic mechanical properties of viscoelastic materials.

--- Part 6: Time-temperature superposition. The purpose is to describe the technical requirements for characterizing the dynamic mechanical properties of viscoelastic materials using time-temperature superposition tests.

Mechanical vibration and shock Dynamic mechanics of viscoelastic materials
Characterization of performance Part 5: Based on measurements and limited Poisson's ratio for meta-analytic comparisons

1 Scope

This document describes two methods for estimating the Poisson's ratio and/or elastic modulus of isotropic viscoelastic or poroelastic materials.

Linear finite element method (FEM) computational models or other numerical methods for vibration or acoustic problems of viscoelastic structures with complex geometries.

This method is based on the comparison of the measurement results with the finite element analysis results, and the load-displacement or stiffness of the disk specimen fixed at the upper and lower ends is calculated.

The measurement results of the characteristics are compared with the finite element analysis results of the same working conditions as a function of Poisson's ratio.

The choice of method depends on whether the target parameter to be measured is only Poisson's ratio or Poisson's ratio and elastic modulus.

It is considered incompressible and exhibits nonlinear behavior, especially when large static deformations occur. Many commercial software can be used to solve this problem.

However, this paper only considers the small deformation behavior in typical vibration problems, so the linear finite element model is sufficient.

It can meet the accuracy requirements and is more convenient.

For the purpose of this document, the term "dynamic mechanical properties" refers to the determination of basic elastic properties, such as the complex Young's modulus, as a function of temperature and frequency.

quantity and Poisson's ratio.

This document applies to isotropic resilient materials commonly used in vibration isolator designs to reduce.

a) The transmission of audible frequency vibration to the structure and the induced fluid radiated sound (air noise, structure-borne radiated sound, etc.);

b) The impact that low-frequency vibration may have on the human body, or the damage that severe low-frequency vibration may cause to structures and equipment.

The measurement methods and data collection and analysis methods specified in this document and ISO 18437-2 to ISO 18437-4 can be used for.

---Design of vibration isolators;

---Selection of optimal resilience material;

--- Theoretical calculation of vibration transmissibility of vibration isolators;

---Information required for product development;

---Product information provided by manufacturers and suppliers;

---Product quality control.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

ISO 472 Plastics-Vocabulary Note. GB/T 2035-2024 Plastics Terminology (ISO 472:2013, NEQ) ring-Vocabulary) Note. GB/T 2298-2010 Mechanical vibration, shock and condition monitoring vocabulary (ISO 2041:2009, IDT) ISO 4664-1 Rubber, vulcanized or thermoplastic - Determination of dynamic properties - Part 1: General guidance Note. GB/T 9870.1-2006 Rubber, vulcanized or thermoplastic - Determination of dynamic properties - Part 1: General principles (ISO 4664-1:2005, IDT)