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Träkonstruktioner – Provningsmetoder – Vibrationer i golv (ISO 18324:2016, IDT)

Timber structures – Test methods – Floor vibration performance (ISO 18324:2016, IDT)

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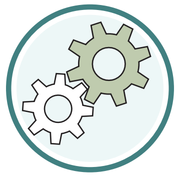

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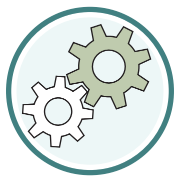

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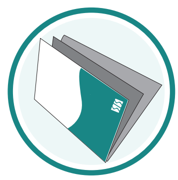

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Den internationella standarden ISO 18324:2016 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 18324:2016.

The International Standard ISO 18324:2016 has the status of a Swedish Standard. This document contains the official English version of ISO 18324:2016.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Bärande träkonstruktioner, SIS / TK 182 / AG 4.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 165, *Timber structures.*

Introduction

Dynamic properties of timber structures are of critical importance to designers since they govern how these structures respond to seismic, wind and in-service human-induced dynamic excitation. Seismic and wind can cause structural failure, while in-service human-induced motion generally causes serviceability problems related to human discomfort; this is also true to wind-induced building motion. Since occupants are constantly in contact with the floor system, vibration serviceability of floor systems is often of concern to designers of timber structures. Vibrational performance of a timber floor can be assessed using parameters such as natural frequencies, damping ratios, dynamic responses to an impulse (dynamic displacement, velocity, and acceleration), and static deflection under a concentrated load. These parameters have been found to correlate well with human perceptions. Among these parameters, natural frequencies, damping ratios, and static deflection under concentrated load are commonly used to evaluate timber floor vibrational performance. Design procedures have been developed, and in some cases implemented in design standards, for assessing vibration serviceability of timber floors. These design procedures usually include criteria for floor response parameters, such as those listed above, and mathematical procedures to calculate these parameters. As an alternative to calculation, it is also necessary to provide standardized procedures to measure these parameters experimentally. This is the prime motive for the development of this ISO test standard.

Natural frequencies and damping ratios of a test system can be measured using modal testing. ISO published a series of International Standards on the application of modal testing and analysis to determine natural frequencies, modal damping ratios, and other dynamic properties of an object. The theory of modal testing and analysis has been well documented in Reference.[4] This International Standard provides practical procedures that can be applied either in the laboratory or in the field to measure natural frequencies, modal damping ratios and static deflection under a concentrated load of a timber floor. It is assumed that users of the International Standard have the necessary equipment and fundamental knowledge to perform modal testing.

This International Standard does not address acceptance criteria for vibrational serviceability.

Timber structures — Test methods — Floor vibration performance

1 Scope

This International Standard specifies test procedures to measure natural frequencies, modal damping ratios and static deflection under a concentrated load of laboratory or field timber floors. These parameters have been found to correlate well with human perception to timber floor vibration response caused by human-induced excitation under normal use. It is intended that the test procedures can be applied in lieu of calculation to quantify some or all of the above parameters that are used to evaluate the vibrational serviceability of the test floor. The subsequent use of the measured parameters to evaluate vibrational serviceability is, however, outside the scope of this International Standard.

ISO published a series of International Standards on the application of modal testing and analysis to determine natural frequencies, modal damping ratios, and other dynamic properties of a structure. For the measurement of dynamic parameters such as natural frequencies and modal damping ratios, modal testing is proposed in this International Standard. It is assumed that the test operators possess the required equipment and fundamental knowledge to perform such a test. The theory of modal testing and analysis has been well documented in Reference [4].

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
coherence function
indicator of the degree of linearity at each frequency component between the input and output signals, i.e., the noise level at each frequency component in the frequency response function (FRF) spectrum

Note 1 to entry: The value of coherence function is one when there is no noise in the signal, and zero for pure noise in the measured signals.

3.2
damping
parameter relating to the dissipation of energy, or more precisely, to the conversion of the mechanical energy associated with a vibration to a form that is unavailable to the vibration

3.3
natural frequency
frequency, associated with a *vibration mode* (3.12), at which a system naturally vibrates once it has been set into motion with a transient excitation

3.4
frequency response function
response function expressed in frequency domain and normalized to the input force

Note 1 to entry: It is the summation of each mode in the modal space. It shows the response of a system to be a series of peaks. Each peak with identifiable centre-frequency is the natural frequency of the system vibrating as if it was a single degree-of-freedom system.

3.5
leakage
effect on measured frequency due to truncating the infinite time response signal during Discrete Fourier Transform

3.6
modal damping ratio
damping ratio associated with a *vibration mode* (3.12)

3.7
modal testing
measurement of the *frequency response function* (3.4)

3.8
modal analysis
process of determining the *natural frequencies* (3.3), *modal damping ratios* (3.6), and *mode shapes* (3.9) of a structure (floor) for the *vibration modes* (3.12) in the frequency range of interest from the *frequency response function* (3.4)

3.9
mode shape
pattern of movement (i.e., dynamic displacement, velocity, acceleration) of a structure (floor) for a *vibration mode* (3.12)

3.10
nodal point
point of zero displacement on a vibrating system of a *mode shape* (3.9) associated with a *vibration mode* (3.12)

3.11
vibration
oscillation of a system about its equilibrium position

3.12
vibration mode
vibration behaviour of a system or object that is characterized by its *natural frequency* (3.3), *modal damping ratio* (3.6) and *mode shape* (3.9)

Note 1 to entry: The free vibration of a continuous structure such as floor system contains a summation of an infinite number of vibration modes.

4 Abbreviated terms

FFT Fast Fourier Transform

FRF Frequency Response Function

5 Measurement of natural frequencies and modal damping ratios

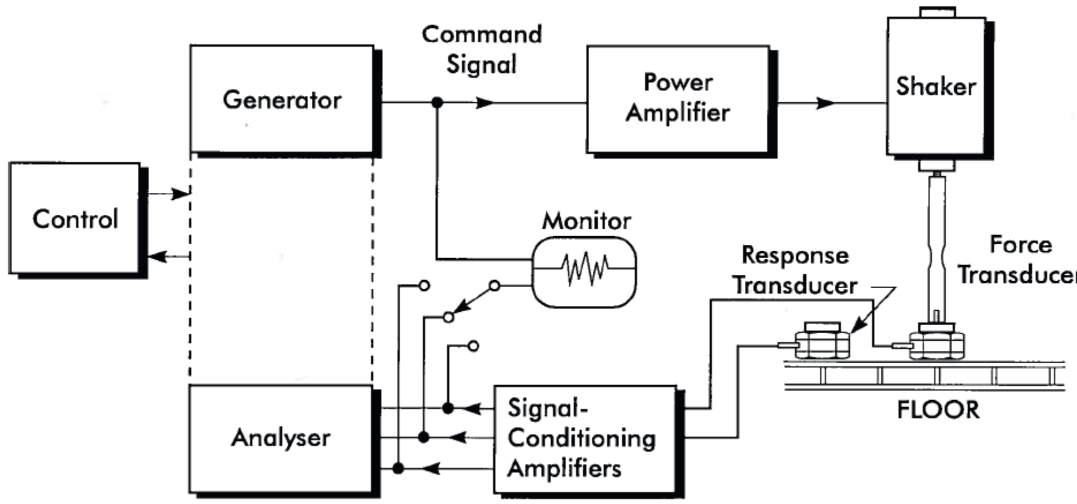
5.1 General

This clause specifies the general procedure of applying modal testing and analysis described in ISO 7626 to timber floors to determine their natural frequencies and damping ratios associated with the vibration modes. Specifically, this clause focuses on two techniques of exciting the out-of-plane vibration of a floor. One technique uses a shaker that is attached to the test floor, and the other uses an impact device that is not attached to the floor.

NOTE A general understanding of the theoretical basis of modal testing is expected in order to apply the procedures described in this clause. This understanding can be acquired by consulting relevant text, e.g. Reference [4].

5.2 Apparatus

The equipment required for modal testing shall consist of three major items: 1) an exciter for inducing vibration; 2) transducers for measuring the time history signal of excitation force and the vibration response; 3) a signal analyser for recording and analysing the time signals and extracting the desired information from the analysis results. Figure 1 illustrates the layout of a modal test system using a shaker as the exciter.



NOTE 1 This figure was a modification of the original figure in Reference [4].

Figure 1 — Layout of a modal test system using a shaker as the exciter

5.2.1 Exciter, shall be provided to initiate vibration in a structure. Generally, a satisfactory exciter for floor testing shall have the following capabilities:

a) Sufficient energy to induce floor vibration so that the modal testing measurements made over the entire frequency range of interest has an adequate signal-to-noise ratio without exciting a nonlinear response;

b) A suitable excitation waveform with frequency content that covers the frequency range of interest.

The exciter shall be either a shaker or an unattached impact device.

5.2.1.1 Attached exciter – shaker, shall be an electro-dynamic, electro-hydraulic, or piezoelectric vibration exciter attached to the test floor. The shaker shall be attached to a selected location on the floor during testing to continuously apply the excitation to the floor.

5.2.1.2 Unattached exciter – impact device, an instrumented hammer with a built-in force transducer or an impact device with a separate force transducer placed on a floor shall be used as the unattached exciter. The impact system shall have sufficient energy and appropriate surface contact characteristics to excite all the frequencies that are of interest. Specific requirements on the impact characteristics are given in 5.3.3.