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Acoustics — Experimental method for transposition of dynamic forces generated by an active component from a test bench to a receiving structure

Acoustique — Méthode expérimentale de transposition des forces dynamiques générées par un composant actif d'un banc d'essai vers une structure réceptrice

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Foreword

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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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The vibroacoustic behaviour of products has become a major challenge not only in terms of user health protection through regulations, but also in terms of sound quality for safety, quality perception, and attractiveness.

At the same time, requirements on products development cycles are more and more stringent, reaching the point where component suppliers and integrators should work independently, without physical prototypes.

To master the transmission of dynamic forces (also called structure-borne noise), one needs to adapt the components to the receiving structure, and hence exchange information prior to manufacturing prototypes. This information will only be valuable for the integrator if it is clearly defined and intrinsic to the component.

This document, issued from a French experimental standard, addresses this issue. It is a user guidance to characterize an active source on a test bench and predict the effects of its integration on a passive structure. The component is characterized on its own, which makes the document complementary to the ISO 20270 that describes the measurement of "in-situ" characteristics (blocked forces), where the component is connected to its receiving structure.

The intrinsic characterization of an active source requires measuring two quantities (expressed as a function of the frequency): the first one characterizing the dynamic aspect, blocked forces, and the second one describing "static" behaviour, such as the impedance or the mobility.

The objective of this document is to help the user predict the component behaviour in a particular assembly. The theoretical background is laid in Annex A. The user is then guided (see 5.2) all along the experimental procedure enabling to reach this objective:

— Static characterization of the component, the test bench and the receiving structure.

— Force measurement: the standard proposes here direct and indirect methods. Indirect methods are generally easier to implement, but they need a particular focus on the measurement quality and matrix inversion.

— Interface integration (connecting device).

— Prediction of the behaviour of the component/receiving structure assembly.

This whole procedure is based on a general formula expressing the dynamic forces in the assembly as a function of blocked forces and static characteristics. Depending on these static characteristics, simplifications are proposed (see 5.6).

Annex B and C guide the user to measure both transfer functions and dynamic forces. It should be noted that, in general, these quantities are expressed in the 3 directions and 3 rotations, but the procedure can be applied on a number of degrees of freedom chosen by the user.

The Annex D informs about data processing. The Annex E contains a test example and the Annex F describes the method using a particular test bench (block sensor).

The data obtained and assessed in this document can be used:

— as part of a specification between suppliers and integrators;

— as input data of numerical vibroacoustic simulation models;

— to drive the modification of the physical structure or the interface in order to improve the vibroacoustic behaviour.

Acoustics — Experimental method for transposition of dynamic forces generated by an active component from a test bench to a receiving structure

1 Scope

This document specifies a method to predict the dynamic forces generated by an active component on a receiving structure from measurement on a test bench.

It sets out the requirements applicable to test benches and setup measurement conditions of dynamic forces: a criterion of validity of transfer functions measurements can be established for example.

The objective is to evaluate noise and vibrations generated by active components mounted on receiving structures, including the possibility to optimise vibration isolators.

It can be applied to different systems connected to a building, such as a compressor or a power generator, or to systems connected to a vehicle body, such as an engine powertrain or an electrical actuator, for example.

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
active component
active substructure which generates dynamic forces

Note 1 to entry: See Figure 1.

3.2
connecting device
mechanical interface with a specific “spring like” matrix structure which allows connecting the *active component* (3.1) to the receiving structure

Note 1 to entry: See Figure 1, Key 2.

Note 2 to entry: Insulators at fixation points are typical “spring like” connecting devices.

Note 3 to entry: A “spring like” connecting device is a structure with no internal degrees of freedom and internal mass, see 3.10.

Note 4 to entry: In the case of a connecting point, active component and receiving structure share the same location.