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Mechanical vibration and shock — Signal processing —

Part 4: Shock-response spectrum analysis

Vibrations et chocs mécaniques — Traitement du signal —

Partie 4: Analyse du spectre de réponse aux chocs

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 18431-4 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*.

ISO 18431 consists of the following parts, under the general title *Mechanical vibration and shock — Signal processing*:

— *Part 1: General introduction*

— *Part 2: Time domain windows for Fourier Transform analysis*

— *Part 4: Shock-response spectrum analysis*

The following parts are under preparation:

— a part 3, dealing with bilinear methods for joint time-frequency analysis

— a part 5, dealing with methods for time-scale analysis

Introduction

In the recent past, nearly all data analysis has been accomplished through mathematical operations on digitized data. This state of affairs has been accomplished through the widespread use of digital signal-acquisition systems and computerized data processing equipment. The analysis of data is, therefore, primarily a digital signal-processing task.

The analysis of experimental vibration and shock data should be thought of as a part of the process of experimental mechanics that includes all steps from experimental design through data evaluation and understanding.

ISO 18431 (all parts) assumes that the data have been sufficiently reduced so that the effects of instrument sensitivity have been included. The data covered in ISO 18431 (all parts) are considered to be a sequence of time samples of acceleration describing vibration or shock. Experimental methods for obtaining the data are outside the scope of ISO 18431 (all parts).

This part of ISO 18431 is concerned with methods for the digital calculation of a shock-response spectrum. The analysis is by no means restricted to signals that can be characterized as shocks. On the contrary, it is, in a strict sense, meaningless to analyze a shock according to the definition in ISO 2041, where a shock is defined as a sudden event, taking place in a time that is short compared with the fundamental periods of concern. Such a shock has no frequency characteristics in the frequency range of concern. It is only characterized by its time integral, the impulse, corresponding to constant frequency content. The notation “shock-response spectrum” has been kept, however, although a better term would be maximum-response spectrum.

Historically, the shock-response spectrum was initially used to describe transient phenomena, at the time called shocks.

Response analysis in general is a method to characterize a vibration or shock when other frequency analysis methods are inadequate. This can be the case, for instance, when different kinds of vibration are compared. Spectrum analysis based on the Fourier Transform produces spectra that are incompatible when the signals analyzed are of different kinds, such as periodic, random or transient.

The typical use of a shock-response spectrum is to characterize a dynamic mechanical environment. The vibration (or shock) characterized is recorded in digital form, commonly as acceleration. The data are analyzed into a shock-response spectrum. This spectrum can then be used to define a test for equipment that is required to endure the environment in question. There exist International Standards that describe how to design tests from given shock-response spectrum specifications, for example IEC 60068-2-81. (See the bibliography for additional information.)

When measurements to characterize a vibration and/or shock environment are performed, it is necessary to take certain measures, for instance to ascertain a proper dynamic load in the measurement points. These measures are beyond the scope of this part of ISO 18431. There are many good handbooks and recommended practices that are helpful in this area [1],[2].