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NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 20485.43-2021

Methods for the calibration of vibration and shock transducers - Part 43: Calibration of accelerometers by model-based parameter identification

Issued on: August 20, 2021 **Implemented on: March 1, 2022**

Issued by: State Administration for Market Regulation, China National Standardization Administration

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Foreword

GB/T 20485 "Vibration and shock sensor calibration method" mainly consists of basic concepts, absolute calibration, comparison calibration, and environmental simulation calibration.

Standards and other five major categories, the published parts are as follows.

---Part 1.Basic concepts;

---Part 11.Absolute Vibration Calibration by Laser Interferometry;

---Part 12.Absolute Vibration Calibration by Reciprocity Method;

---Part 13.Absolute calibration of impact by laser interferometry;

---Part 15.Absolute calibration of angular vibration by laser interferometry;

---Part 16.Earth Gravity Method Calibration;

---Part 21.Vibration comparison method calibration;

---Part 22.Impact comparison method calibration;

---Part 31.Transverse vibration sensitivity test;

---Part 33.Magnetic Sensitivity Test;

---Part 41.Laser Vibrometer Calibration;

---Part 42.Gravitational acceleration method calibration of high-precision seismometers;

---Part 43.Accelerometer calibration based on model parameter recognition.

The parts planned to be released are.

---Part 17.Centrifuge method absolute calibration;

---Part 32.Response test of accelerometer frequency and phase response test of shock excitation method;

---Part 44.On-site vibration calibrator calibration;

---Part 45.Vibration sensor calibration with built-in calibration coil.

This part is part 43 of GB/T 20485.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

The translation method used in this part is equivalent to the ISO 16063-43.2015 (revised in.2016) "Vibration and shock sensor calibration method"

Part 43.Accelerometer calibration based on model parameter identification".

The Chinese documents that have a consistent correspondence with the international documents cited in this section are as follows.

---GB/T 20485.1-2008 Vibration and shock sensor calibration method Part 1.Basic concepts (ISO 16063-1.1998);

---GB/T 20485.11-2006 Vibration and shock sensor calibration method part 11.laser interferometry vibration absolute calibration

(ISO 16063-11.1999,IDT);

---GB/T 20485.13-2007 Vibration and shock sensor calibration method part 13.laser interferometric shock absolute calibration

(ISO 16063-13.2001,IDT);

---GB/T 20485.21-2007 Vibration and shock sensor calibration method Part 21.Vibration comparison method calibration

(ISO 16063-21.2003, IDT);

---GB/T 20485.22-2008 Vibration and shock sensor calibration method part 22.shock comparison method calibration

(ISO 16063-22.2005, IDT);

---JJF1059.1-2012 Measurement Uncertainty Evaluation and Expression (ISO /IEC GUIDE98-3.2008);

---JJF1059.2-2012 Monte Carlo method is used to evaluate measurement uncertainty (ISO /IEC GUIDE98-3-SP1.2008).

Introduction

ISO 16063 (all parts) in its different parts (ISO 16063-1, ISO 16063-11, ISO 16063-13, ISO 16063-21

And ISO 16063-22) specify the device and procedures for calibrating vibration sensors. The methods used can be divided into two categories, the first category is

The steady-state signal is a sine or multi-sine excitation; the second type is a transient signal, which is an impulse excitation. The former is due to its inherent periodic repetitiveness

The optimal measurement uncertainty can be obtained; while the latter is mainly aimed at the high frequency that the periodic excitation cannot be achieved due to the power limitation of the calibration system.

Intensive motivation.

The result of the first type of calibration is given in the form of complex transfer sensitivity in the frequency domain, so it cannot be directly used for time-domain transient signals.

The result of the second type of calibration is a single value, the real-time domain peak ratio. This ratio (intentionally) ignores the sensor pair in its resonance frequency band.

There is a frequency-dependent dynamic response of the component of the transient input signal. Because of this "peak ratio feature", the calibration result is usually

The shape of the transient input signal used has a strong correlation with the device used.

This will have the following two serious consequences.

a) The impact excitation calibration according to ISO 16063-13 or ISO 16063-22 is limited in the use of value transfer.

That is, the shock sensitivity Ssh obtained by the laboratory calibration using the absolute method may be installed in the laboratory using the comparison method.

It cannot be used if it is placed on top. The reason is that the shape of the input excitation signal is different, which leads to the generation of the spectral structure of the impact excitation signal of the comparison method.

The difference.

b) If the calibration device uses input signals with different frequency components, such as in the verification of the effectiveness of a certain approval process, discuss the measurement

It is not feasible to compare the calibration results obtained by different calibration devices when the uncertainty of measurement is used to evaluate the consistency problem.

The method adopted in this section is to use the accelerometer as a dynamic system described by a mathematical model with mechanical input and electrical output.

This power output is assumed to be proportional to the inherent mechanical quantity (such as deformation) of the accelerometer. In the established method (ISO 16063-

11.Based on the data obtained from the calibration of ISO 16063-13, ISO 16063-21 and ISO 16063-22), determine the estimated values of the model parameters to

And the corresponding uncertainty. The quantified parameters and their corresponding uncertain complete models can be used to calculate the sensor's response to any transient information.

The time domain response of the signal (including the uncertainty related to time), or the time output signal (ISO 16063-11

Or ISO 16063-13) to estimate the unknown sensor transient input signal.

In addition, this method can also provide the continuous frequency domain transfer sensitivity estimation of this model.

In short, the methods and processes specified in this section can enable users to perform the following tasks.

---Calibrate the vibration sensor used to accurately measure the transient input;

---Using transient excitation to compare and measure effectiveness;

---Predict the transient input signal and its measurement uncertainty over time;

---Compensate the frequency response characteristics of the vibration sensor (real-time), thereby expanding the applicable bandwidth of the sensor.

Vibration and shock sensor calibration method