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GB/T 20485.42-2018

Methods for the calibration of vibration and shock transducers -- Part 42: Calibration of seismometers with high accuracy using acceleration of gravity

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Foreword

GB/T 20485 "Vibration and Shock Sensor Calibration Method" mainly consists of basic concepts, absolute calibration, comparison calibration, environmental simulation

It is composed of the other five categories, and the released parts are as follows.

--- Part 1. Basic concepts;

--- Part 11. Laser interference method vibration absolute calibration;

--- Part 12. Reciprocal method vibration absolute calibration;

--- Part 13. Absolute calibration of laser interference method;

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

--- Part 16. Calibration of the Earth Gravity Method;

--- Part 21. Vibration comparison method calibration;

--- Part 22. Impact comparison method calibration;

--- Part 31. Lateral vibration sensitivity test;

--- Part 33. Magnetic sensitivity test;

--- Part 41. Laser vibrometer calibration;

--- Part 42. Gravity acceleration calibration of high precision seismometers.

The parts that are planned to be released are.

--- Part 17. Absolute calibration by centrifuge method;

--- Part 32. Accelerometer frequency and phase response tests in response to test impulse excitation methods;

--- Part 43. Accelerometer calibration based on model parameter identification;

--- Part 44. Field vibration calibrator calibration;

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

This part is the 42nd part of GB/T 20485.

This part is drafted in accordance with the rules given in GB/T 1.1-2009.

This part uses the translation method equivalent to ISO 16063-42.2014 "Vibration and shock sensor calibration method Part 42. High precision

Gravity Acceleration Calibration of Seismometers.

This part is proposed and managed by the National Technical Committee for Standardization of Mechanical Vibration, Shock and Condition Monitoring (SAC/TC53).

This section drafted by. China Institute of Metrology, Institute of Engineering Mechanics of China Earthquake Administration, Shaanxi Institute of Metrology.

1 Scope

This part of GB/T 20485 specifies the use of local gravitational acceleration (local gravitational force; local acceleration generated by Earth's gravity)

Degree value) As a reference value, instruments and procedures for accurate calibration of seismometer sensitivity.

This section applies to servo-type accelerometers with or without speed signal output, which usually have a mass position output, and the bandwidth is

Broadband seismometers from 0.003 Hz to 100 Hz.

The method specified in this section allows the user to obtain orders of magnitude as low as 1 x 10-5 m/s2 (equivalent to 1 mGal and approximately 1 x 10-6 gravity acceleration)

The static sensitivity of the seismometer.

The acceleration expansion uncertainty (k=2) obtained by the present method is 1 x 10 -6 m/s 2 (0.1 mGal). When using the instructions described in this section

In the case of an absolute gravimeter, the measurement uncertainty of acceleration can be reduced to within 5 x 10-8 m/s2 (5 μGal). Not counted by the device under test

(DUT) introduced uncertainty, the relative expansion uncertainty of the calibration is 0.5%.

The intended use of the seismometer is as follows.

a) Earth science observations including geophysical applications;

b) disaster prevention, such as monitoring of landslide precursors;

c) reliability diagnosis of building structures and foundations in civil engineering;

d) Nuclear test monitoring.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only dated versions apply to this article.

Pieces. For undated references, the latest edition (including all amendments) applies to this document.

IGSN-71, Moreli, Carlo, ed., 1974. International Gravity Standardization Network 1971. Special Publications of the International Association of Geodesy

No.4,194p

3 Traceability of measurement

See Appendix B for traceability of measurements in this method.

4.1 Method of using absolute gravimeter

Determine the local absolute gravitational acceleration using a free fall absolute gravimeter (FG5 or other device). The local weight obtained thereby

The extended uncertainty of the force acceleration is approximately 5x10-8 m/s2 (5 μGal).

4.2 Method of using gravity acceleration normalization net and relative gravimeter

At the local gravity acceleration reference point established by IGSN-71, a relative gravimeter can be used to determine the local absolute gravity acceleration.

degree. In this case, there is no need to correct the latitude and altitude. The extended uncertainty value of the relative gravimeter is given by the manufacturer.

National Geological Exploration Institute, Meteorological Institute, Geodesy or Geophysics Institute can provide uncertainty than IGSN-71

Smaller gravitational acceleration measurements. This value can be used if possible.

4.3 Method of standardizing the net using gravity acceleration

Based on the latitude and altitude of the measurement point, the local gravity acceleration can pass the nearest relative geographic point given in the IGSN-71 database.

The value is calculated.

The uncertainty of the local gravity acceleration thus obtained is approximately 1 x 10-5 m/s2 (1 mGal). This method is only applicable to no

He is a situation with irregular terrain.

National Geological Exploration Institute, Meteorological Institute, Geodesy or Geophysics Institute can provide uncertainty than IGSN-71

Smaller gravitational acceleration measurements. This value can be used if possible.

Since the 1m height difference is equivalent to a gravitational acceleration change of about 3x10-6m/s2 (0.3mGal), the uncertainty of the height difference measurement is uncertain.

The degree should be less than 2m.

Note 1. The effect of the 1° deviation at a latitude of approximately 45° corresponds to a change in gravitational acceleration of approximately 1 x 10 -6 m/s 2 (0.1 mGal).

Note 2. The local gravity map includes the geoid and altitude values.

5.1 Calibration environment