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Non-destructive testing — Acoustic emission testing — Test method for classification of active cracks in concrete structures

Essais non destructifs — Contrôle par émission acoustique — Méthode de test pour la classification des fissures actives dans les structures en béton

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Foreword

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This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 9, *Acoustic emission testing*.

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Introduction

The number of aged concrete structures has been increasing all over the world. Since cracking is one major cause of damages in reinforced concrete (RC) structures, evaluation methods for crack distribution and cracking mechanisms are in great demand. To make a decision on maintenance and repair in concrete structures, non-destructive evaluation (NDE) techniques are often applied to estimate the safety and the performance of current state of concrete structures.

It is well known that acoustic emission (AE) technique is promising to test concrete structures for damage estimation. In this respect, a test method for classifying active cracks is established. Due to damage evolution in concrete structures in service, AE events are observed. Initially the tensile type of cracks in the microscopic scale is generated with short nucleation time. As approaching eventual failure, the shear type of cracks with long dislocation time is predominantly generated rather than the tensile type. Depending on these crack types, it is found that the shape of AE waveform changes. In frequency domain the tensile type has the higher frequency while the shear type has the lower frequency.

Thus, AE parameter-based method (parameter analysis) has been applied to crack classification. The proportion of the two AE parameters of the average frequency and the RA value is applied to classify cracks into tensile and shear cracks.

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Non-destructive testing — Acoustic emission testing — Test method for classification of active cracks in concrete structures

1 Scope

This document specifies a test method for classification of active cracks in concrete structures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12713, *Non-destructive testing — Acoustic emission inspection — Primary calibration of transducers*

ISO 12714, *Non-destructive testing — Acoustic emission inspection — Secondary calibration of acoustic emission sensors*

ISO 12716, *Non-destructive testing — Acoustic emission inspection — Vocabulary*

ISO/TR 13115, *Non-destructive testing — Methods for absolute calibration of acoustic emission transducers by the reciprocity technique*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12716 and the following 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 http://www.electropedia.org/

3.1
RA value
reciprocal of a wave gradient, obtaining the rise time divided by the peak amplitude

3.2
average frequency
F_a
apparent frequency, obtained as counts divided by the duration time

4 Measurement system

4.1 AE sensor

AE sensors shall be calibrated properly in advance of the measurement in accordance with ISO 12713, ISO 12714 and ISO/TR 13115. AE sensors shall be sensitive enough to detect AE signals generated in a concrete structure, taking acoustic coupling into consideration. AE sensor shall also be robust enough against temperature change, moisture condition and mechanical vibrations in the environments.

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