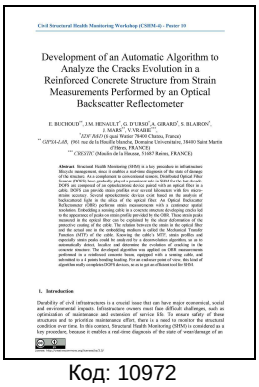

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Development of an Automatic Algorithm to Analyze the Cracks Evolution in a Reinforced Concrete Structure from Strain Measurements Performed by an Optical Backscatter Reflectometer

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Structural Health Monitoring (SHM) is a key procedure in infrastructure lifecycle management, since it enables a real-time diagnosis of the state of damage of the structure. As a complement to conventional sensors, Distributed Optical Fiber Sensors (DOFS) have gradually played a prominent role in SHM for the last decade. DOFS are composed of an optoelectronic device paired with an optical fiber in a cable. DOFS can provide strain profiles over several kilometers with few micro-strains accuracy. Several optoelectronic devices exist based on the analysis of backscattered light in the silica of the optical fiber. An Optical Backscatter Reflectometer (OBR) performs strain measurements with a centimeter spatial resolution. Embedding a sensing cable in a concrete structure developing cracks led to the appearance of peaks on strain profile provided by the OBR. These strain peaks measured in the optical fiber can be explained by the shear deformation of the protective coating of the cable. The relation between the strain in the optical fiber and the actual one in the embedding medium is called the Mechanical Transfer Function (MTF) of the cable. Knowing the cable's MTF, strain profiles and especially strain peaks could be analyzed by a deconvolution algorithm, so as to automatically detect, localize and determine the evolution of cracking in the concrete structure. The developed algorithm was applied on OBR measurements performed in a reinforced concrete beam, equipped with a sensing cable, and submitted to a 4 points bending loading. For an end-user point of view, this kind of algorithm really completes DOFS devices, so as to get an efficient tool for SHM.

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Ключевые слова:

Содержание