Ultrasonic assessment of mechanical damage in concrete

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Abstract

The last decades have witnessed a growing demand for nondestructive evaluation (NDE) methods. NDE methods allow the assessment of aging structures, quality control of new ones and the investigation of specific processes and phenomena such as hardening of concrete and fatigue crack propagation on steel. In Civil Engineering NDE methods have reached a great importance and have been largely used for maintenance and diagnosis of concrete.

Concrete structures, since concrete is a highly complex structural material whose properties change according to mix proportions and also due to loading conditions, can greatly benefit from NDE methods. Among the techniques available to investigate concrete, ultrasound is the only one that allies flexibility, low cost, and the capability of yielding information about the microscopic concrete internal structure. For this reason, ultrasound has been used to evaluate diffuse forms of damage in concrete. Ultrasonic investigation delivers three complex interrelated parameters that are associated with wave propagation in dispersive heterogeneous media: velocity, amplitude, and attenuation. These three parameters can be used to analyze diffuse properties of concrete and changes on its characteristics due to mechanical loading, chemical attack or environmental actions.

In the seminar, some results related to the application of ultrasound to investigate concrete under uniaxial compression will be presented. Experiments were conducted to evaluate microcrack growth and degradation of elastic properties in concrete using ultrasonic pulses. Changes in the amplitude, velocity, and frequency contents of the pulses were correlated to the increasing levels of stress. Results have showed that damage estimators based on pulse velocity can be used to assess diffuse mechanical damage in concrete.

Bio. Dr. Nogueira finished his doctorate program in 2000, at the University of Colorado, and since then has been teaching and working with nondestructive evaluation of structures. In the past few years Dr. Nogueira has been conducting research on ultrasonic investigation of mechanical damage in concrete. In January 2016 Dr. Nogueira joined the University of Colorado Denver as Research Assistant Professor.

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