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Criticality Hidden in Acoustic Emission Time Series from Concrete Specimen Under Compression†

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Abstract: Load-carrying capability and evolving crack damage of a cube-shaped concrete specimen have been assessed during a laboratory compression test carried up to fracture. Damage assessment has been carried by Acoustic Emission (AE) monitoring technique, through a network of six resonant PZT transducers. Besides classical methods of AE data analysis, including 3D AE source location and b-value analysis, the application of a recently proposed approach based on Natural Time (NT) analysis is herein proposed [1,2]. The present study focuses on identifying the entrance of the system into a critical condition, through the definition of a critical NT parameter, to be extracted from the AE signal time series, as a pre-failure indicator. The numerical simulation of this test using a version of the Discrete Element method [3,4] allowed to understand some aspect of the damage evolution in the specimen regions, close to the formation of the critical cracks, that led to the collapse.

Keywords: acoustic emission; damage evolution; compression tests; acoustic emission; *b*-value; natural time analysis

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