ACEX2019

13th International Conference on Advanced Computational Engineering and Experimenting
ATHENS (Greece) from 1-5 July, 2019

On self-sensing capability of nanocomposites and CNT-doped fiber reinforced composites under different mechanical tests

Claudio Sbarufatti

Politecnico di Milano, Dipartimento di Meccanica,
Via La Masa 1, 20156, Milano, Italy

ABSTRACT

In the last decades, the interest on fiber reinforced polymers (FRPs) has increased due to their mechanical properties and weight saving potential. This has led to the development of novel inspection techniques as the failure modes on composite structures are often complex to identify. In this regard, carbon nanotubes (CNTs), since they were discovered, have been widely used for Structural Health Monitoring (SHM) purposes due to their excellent electrical properties and piezoresistive behaviour which lead to higher sensitivities than other conventional techniques. In particular, the correlation between electrical properties and mechanical behaviour on CNT doped nanocomposites is well known, and a lot of analytical and numerical models have been proposed. However, most of these studies consider static and quasi-static load configuration, being the dynamic electromechanical behaviour still unknown.

In this context, experimental results with dynamic acquisition of electrical signals from CNTs network are presented for different mechanical tests, based on either voltage measurements, at constant current, or current measurements, fixing the applied voltage. The results of impact tests on CNT doped glass FRP, fracture toughness tests on nanocomposites and fatigue tests on carbon FRP bonded joints using a CNT doped adhesive film prove the validity and applicability of the method. The electrical signals have been correlated with the mechanical behaviour of the material, providing information on the system dynamic response and, simultaneously, on the way damage is propagating.