Capacitive Nondestructive Evaluation of Polymer-Based Materials

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Abstract

Techniques for nondestructive inspection of metals have been well-established for many years. Presently, increased attention is being focused on the development of methods for nondestructive inspection of non-metals, motivated in part by the development of polymer-based structural materials, e.g. fiberglass composites for oil pipelines and carbon-fiber composites for aerospace applications, and also by the aging of polymeric components in critical systems such as nuclear power plant control cables. In many polymers, chemical and physical degradation result in a change in the electrical properties (i.e. the permittivity) of the material. This suggests that capacitive NDE, in which the permittivity of the material is measured, is potentially suitable for the inspection and/or long-term monitoring of such materials. This talk describes the design and testing of capacitive sensors for several applications such as i) detection of anomalies in fiberglass composites and ii) characterization of degradation in polymeric insulator materials.

Biography

Nicola Bowler received a B.Sc. degree in physics from the University of Nottingham, UK, in 1990 and the Ph.D. degree from the University of Surrey, UK, in 1994, for theoretical work in the field of eddy-current nondestructive evaluation (NDE). She moved to the Center for NDE, Iowa State University, in 1999 and in 2006 was appointed Associate Professor of Materials Science and Engineering at Iowa State University. She was promoted to the rank of full Professor in 2012. Her research interests include engineering the electromagnetic properties of composite materials by analysis and design, and electromagnetic NDE of dielectrics, composites and metals; inventing new NDE techniques and improving accuracy in capacitive, four-point potential drop, eddy-current and microwave NDE. She served as a Senior Associate Editor of the IEEE Transactions on Dielectrics and Electrical Insulation for two years, as a technical editor of the Journal of Nondestructive Evaluation, published by Springer, for two years, and is presently an Associate Editor of Measurement Science and Technology, published by the Institute of Physics. Nicola was awarded the Akinc Excellence in Teaching Award in 2011, by the MSE Department, in recognition of outstanding teaching performance, and the Akinc Excellence in Research Award in 2012 in recognition of outstanding achievement in research.