

Tutorial title: **Advances in Microwave Materials Characterization for NDT of Complex Structures: Theory, Methods, and Applications**

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Abstract:

Health monitoring of infrastructure (cement-based, composite structures, etc.) is an important ongoing issue in many industries. As such, materials characterization methods are becoming increasingly important for these applications. Microwave nondestructive testing (NDT) techniques have shown success as a materials characterization tool for such applications. This talk will present a comprehensive treatment of microwave materials characterization as applied to NDT of complex structures. The tutorial will begin with an overview of different materials characterization methods including freespace, cavity, loaded waveguide, and open-ended waveguide techniques. Examples of representative applications and measurements using a number of these techniques will be discussed. The second half of the tutorial will focus on recent advances of microwave materials characterization for complex structures. This will include evaluation of thin layered structures (backed by a conductor or dielectric), materials with gradient properties such as cement-based materials undergoing moisture/chloride ingress, and how evaluation of the temporal behaviour of dielectric properties can provide valuable information about a material. The role of dielectric mixing models in materials characterization will also be discussed, as will the results of a study on the effect of sample preparation on dielectric property recalculation.