

Multi-Parameter Measurement of "Insulator-Conductor" Hybrid Structure using Capacitive-Inductive Dual-Mode Sensor

Mingrui Zhao¹, Xiaokang Yin¹, Guojun Fan¹, Wei Li¹, Xin'an Yuan¹

¹Intelligent Sensing and Non-destructive Testing Research Center, China University of Petroleum (East China), China

Hybrid structures consisting of two or more layers of materials with different properties have been widely used due to their better performance. But it is their layered structure that makes non-destructive measurements of the physical parameters of specific material layers difficult. However, anomalous variations in these physical parameters usually signal malfunction or failure of these hybrid structures. Previous studies have shown that the capacitive-inductive dual-mode detection technique can be used to determine the nondestructive detection of defects in different material layers of hybrid structures. Therefore, it is possible to use this technique to achieve multi-parameter measurement and inversion of such structures. In this study, an "insulator-conductor" hybrid structure consisting of bio-material layers with an insulated cladding and a conductive substrate is taken as the object. The thickness of the insulated layer, the permittivity of the insulated layer, and the conductivity of the conductive layer on the measured results of the dual-mode detection are investigated. Furthermore, a multi-parameter measurement method based on the dual-mode measured results is designed and several sets of specimens are produced to verify the accuracy. The experimental results show that the proposed multi-parameter measurement and inversion method can quickly and accurately determine the parameters of each material layer of "insulator-conductor" hybrid structures.