Computational Electromagnetics and Model-Based Inversion: A Modern Paradigm for Eddy-Current Nondestructive Evaluation (Scientific Computation)

Harold A Sabbagh, R. Kim Murphy, Elias H. Sabbagh, John C. Aldrin, Jeremy S Knopp

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This volume will define the direction of eddy-current technology in nondestructive evaluation (NDE) in the twenty-first century. It describes the natural marriage of the computer to eddy-current NDE, and its publication was encouraged by favorable responses from workers in the nuclear-power and aerospace industries. It will be used by advanced students and practitioners in the fields of computational electromagnetics, electromagnetic inverse-scattering theory, nondestructive evaluation, materials evaluation and biomedical imaging, among others, and will be based on our experience in applying the subject of computational electromagnetics to these areas, as manifested by our recent research and publications. Finally, it will be a reference to future monographs on advanced NDE that are being contemplated by our colleagues and others. Its importance lies in the fact that it will be the first book to show that advanced computational methods can be used to solve practical, but difficult, problems in eddy-current NDE. In fact, in many cases these methods are the only things available for solving the problems.

The book will cover the topic of computational electromagnetics in eddy-current nondestructive evaluation (NDE) by emphasizing three distinct topics: (a) fundamental mathematical principles of volume-integral equations as a subset of computational electromagnetics, (b) mathematical algorithms applied to signal-processing and inverse scattering problems, and (c) applications of these two topics to problems in which real and model data are used. This will make the book more than an academic exercise; we expect it to be valuable to users of eddy-current NDE technology in industries as varied as nuclear power, aerospace, materials characterization and biomedical imaging. We know of no other book on the market that covers this material in the manner in which we will present it, nor are there any books, to our knowledge, that apply this material to actual test situations that are of importance to the industries cited. It will be the first book to actually define the modern technology of eddy-current NDE, by showing how mathematics and the computer will solve problems more effectively than current analog practice.

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