MICROWAVE AND MILLIMETER-WAVE NEAR-FIELD IMAGING: APPLICATIONS, METHODS AND CHALLENGES

Abstract: In the last decade, we have witnessed dramatic decrease in the price and size of high-frequency electronics along with the increased functionality of on-chip transceivers and radars. This has spurred unprecedented growth in imaging, sensing and detection applications, which define the current and future growth of wireless technology. We will introduce the methods of microwave and millimeter-wave imaging, which allow to "see" inside optically opaque objects. The electromagnetic models of wave propagation that link the object's electrical properties to the microwave measurements are briefly introduced with an emphasis on the approximations, which enable real-time image reconstruction. We will discuss the possible detrimental effects of these approximations on the reconstructed images and how these effects can be mitigated through the careful design of the acquisition apparatus and through data processing. We will briefly dive into the inner workings of two reconstruction methods, namely, microwave holography and the scattered-power mapping, along with examples of quantitative image reconstruction of complex dielectric objects.

Short Biography

Natalia K. Nikolova (IEEE S'93–M'97–SM'05–F'11) received the Dipl. Eng. (Radioelectronics) degree from the Technical University of Varna, Bulgaria, in 1989, and the Ph.D. degree from the University of Electro-Communications, Tokyo, Japan, in 1997. From 1998 to 1999, she held a Postdoctoral Fellowship of the Natural Sciences and Engineering Research Council of Canada (NSERC) at two Canadian universities, Dalhousie University and McMaster University. In 1999, she joined the Department of Electrical and Computer Engineering at McMaster University, where she is currently a Professor. Her research interests include inverse scattering, microwave imaging, as well as computer-aided analysis and design of high-frequency structures and antennas. Prof. Nikolova has authored more than 260 refereed manuscripts, 5 book chapters, and the book "Introduction to Microwave Imaging" published by Cambridge University Press in 2017. She has delivered 47 invited lectures around the world on the subjects of microwave imaging and detection as well as computer-aided electromagnetic analysis and design.

Prof. Nikolova is a Canada Research Chair in High-frequency Electromagnetics. She is a Fellow of the IEEE and a Fellow of the Canadian Academy of Engineering (CAE). She served as an IEEE Distinguished Microwave Lecturer from 2010 to 2013.