IEEE-MTT Chapter Presentation

Resolution and Noise in Imaging

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Abstract

One of the fundamental features characterizing different types of imaging is the related resolution. It describes quantitatively the amount of details an image contains. In e.g. optical imaging (photography), the resolution is defined as the smallest distance between two still distinguishable points. The resolution of a certain type of imaging depends generally on the apparatus used for constructing the image as well as other physical limitations. The latter are related to the nature of the physical quantity (signal) used to construct the image (optical, acoustic, microwave. etc.).

In order to be able to systematically investigate the resolution related to a certain type of imaging, two types of resolutions have to be distinguished, namely the lateral and the depth ones. While the former generally depends on the used hardware, the latter is essentially related to the nature of the imaging signal. Both can be improved if suitable signal processing is used giving rise to what is called "Super Resolution Techniques". These techniques can be shown to be essentially based on the interchangeability between bandwidth and signal-to-noise ratio described by the well known "Shannon" information-capacity equation.

The above mentioned issues are considered in this talk in details. Microwave imaging represented by "Ground Penetrating Radar" (GPR) and its extension to Terra-Hertz range are emphasized. Sample results of the GPR research at the Chair of Microwave and Communication Engineering of the University of Magdeburg are presented and discussed.

Biography

Prof. Omar received the B.Sc., M.Sc. and Doktor-Ing. degrees in electrical engineering in 1978, 1982 and 1986, respectively. He has been professor of electrical engineering since 1990 and director of the chair of microwave and communication engineering at the University of Magdeburg, Germany since 1998. He authored and co-authored more then 300 technical papers extending over a wide spectrum of research areas. His current research fields cover the areas of microwave, NMR and ultrasonic imaging, remote sensing, microwave measurements, in- and outdoor positioning systems, wideband wireless (terrestrial and mobile) communication, subsurface tomography and ground penetrating radar (GPR), ultra wideband antennas and field theoretical modeling of microwave systems and components. He is IEEE Felow.

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Invited by: Prof. R. Mansour & Prof. Safavi-Naeini