Abstracts

FDTD Analysis of the Radiometric Temperature Measurement of a Bilayered Biological Tissue Using a Body-Contacting Waveguide Probe

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Radiometric signal received by an open-ended rectangular waveguide probe in direct contact with a bilayered biological tissue is analyzed by the FDTD method. Two-layer tissue model consists of an outer thin skin layer over a semi-infinite fat layer is analyzed for a X-band total power radiometer. A spherical tumor with same permittivity as, but slightly higher temperature than, the surrounding normal fat tissue is assumed to exist inside the fat tissue. Active probe characteristics are analyzed first using the FDTD method for a propagating, sinusoidally time-varying, TE/sub 10/ type of excitation source. For the same waveguide probe operated as the radiometer antenna, radiometric weighting factors associated with individual tissue cells are then derived from the FDTD calculated field values. Near field radiating characteristics of the probe and radiometric signals determined for tumors of various size and depth are discussed. Presence of the skin is found to result in lower power transmission coefficient across the probe aperture and significantly lower absorbed powers by fat; both of these contribute to much lower radiometric signals observed.

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