Abstracts

Unexpected physical phenomena indicated by FDTD modeling of the Sigma-60 deep hyperthermia applicator

C.E. Reuter, A. Taflove, V. Sathiaseelan, M. Piket-May and B.B. Mittal. "Unexpected physical phenomena indicated by FDTD modeling of the Sigma-60 deep hyperthermia applicator." 1998 Transactions on Microwave Theory and Techniques 46.4 (Apr. 1998 [T-MTT]): 313-319.

We investigate the numerical convergence properties of two-dimensional (2-D) and three-dimensional (3-D) finite-difference time-domain (FDTD) models of the BSD-2000 Sigma-60 annular phased array used for deep hyperthermia. The FDTD modeling data indicate unexpected physical phenomena for the case of Sigma-60 excitation of an elliptical tissue phantom embedded in a circular water bolus. These phenomena include: (1) high-Q energy storage; (2) electromagnetic (EM) mode flipping within the water bolus/phantom; and (3) whispering-gallery transmission of energy to the opposite side of the phantom relative to the exciting dipole pair. We conclude that these phenomena substantially impact the FDTD numerical modeling of this system, and further conclude that the whispering-gallery effect can impact clinical applications of the Sigma-60.

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