Abstracts

FDTD analysis of microwave hearing effect

Y. Watanabe, T. Tanaka, M. Taki and S. Watanabe. "FDTD analysis of microwave hearing effect." 2000 Transactions on Microwave Theory and Techniques 48.11 (Nov. 2000, Part II [T-MTT] (Special Issue on Medical Application and Biological Effects of RF/Microwaves)): 2126-2132.

This paper presents a numerical analysis of the thermoelastic waves excited by the absorbed energy of pulsed microwaves in a human head. First, the authors calculate the distribution of the specific absorption rate using a conventional finite-difference time-domain (FDTD) algorithm for the Maxwell's equation. They then calculate the elastic waves excited by the absorbed microwave energy. The FDTD method is again applied to solve the elastic-wave equations. The validity of the analysis for elastic waves is confirmed through comparison of the FDTD results with the analytical solutions in a sphere model. Two anatomically based human head models are employed for numerical calculations. The waveforms of the calculated pressure waves are different from the previously reported ones. It is especially shown that the surface heating is important in exciting the fundamental mode of the pressure waves in the head. The pulsewidth dependency of the loudness of microwave hearing is clearly explained by the simulation with realistic head models. The peak pressure of elastic waves in the realistic head models is of the same order as the previously reported values obtained with a homogeneous sphere model. The strength of elastic wave is discussed in consideration of the safety of this phenomenon.

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