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Energy Transmission into the Human Hand from Vibrating Tools

Douglas D. Reynolds
University of Nevada, Las Vegas, reynolds@nscee.edu

have suggested such mechanisms as relaxation of proton-transfer equilibria occurring at ionizable residues and relaxation of solvent–solute equilibria. Though other mechanisms have been proposed, no single mechanism appears to be predominant in being responsible for ultrasonic absorption by proteins.

10:00

FF3. The contribution of absorption to tissue attenuation. Kevin J. Parker (Department of Electrical Engineering, University of Rochester, Rochester, NY 14627)

The relative contributions of ultrasonic scattering and absorption to the overall attenuation coefficient of tissues is an important issue in diagnostic and therapeutic ultrasound. This paper presents a range of experimental evidence and case studies which support the postulate that absorption dominates attenuation in soft tissues. Comparisons of tissue absorption coefficients (using thermal pulse decay) and attenuation coefficients (using radiation force insertion loss) are given, along with results of tissue homogenization experiments. Other evidence is gained from measurements of total scattered power, and clinical observations of backscatter and attenuation of focal lesions. Finally, comparisons are made of the attenuation of dilute protein solutions and whole liver specimens, in order to establish the role of multiple relaxation mechanisms at the macromolecular level in the overall attenuation coefficient of mammalian liver tissue.

10:30

FF4. Calculation of temperature elevation caused by ultrasound absorption. Wesley L. Nyborg (Physics Department, University of Vermont, Burlington, VT 05405)

It has been known for decades that ultrasound is capable of producing physiological change in man and in laboratory animals. A dominant mechanism for the change is temperature elevation resulting from sound absorption. It has been shown for some situations that the processes for heat generation and transport are understood well enough to make it feasible to predict the temperature that results from specific acoustic exposures. Thus Pond, Robinson and Lele, Carstensen, Lizzi, and others have successfully calculated intensity–time combinations required for production of recognizable lesions in mammalian tissues and other media. There is now special interest in computational methods for application to ultrasonic hyperthermia, and also to the formulation of safety criteria for diagnostic ultrasound. For the latter purpose a simplified method has been developed, based on a Green's function solution to the bio-heat transfer equation. In this paper, previous work on temperature calculations is reviewed, and recent results discussed.

11:00

FF5. Energy transmission into the human hand from vibrating tools. Douglas D. Reynolds (Department of Civil and Mechanical Engineering, University of Nevada–Las Vegas, Las Vegas, NV 89154)

A method for calculating power transmitted to the hands of operators who use vibrating hand tools is presented. Results that relate to a comprehensive multidisciplined NIOSH field study of several hundred chipper and grinder workers who used pneumatic hand tools are discussed. These results indicated that the total power in the frequency range of 6.3 to 1000 Hz transmitted to the hand ranged from 1080 to 7230 J/s for the chisel and from 0.852 to 157 J/s for the handle of chipping hammers. For pneumatic grinders the power transmitted to the hands of the tool operators was in the range of 0.00658 to 0.235 J/s over the same frequency range.