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Numerical Analysis on Ultrasound Propagation and Temperature Rise in Focused Ultrasound Treatment with Navier-Stokes Equation MITSUAKI KATO, SHIN YOSHIZAWA, YOICHIRO MATSUMOTO, Department of Mechanical Engineering, The University of Tokyo, KENJI ONO, RIKEN — The linear and nonlinear approximation equations which have been usually used in the ultrasound field simulation, have the restrictions such that the higher order nonlinearity or the reflection and refraction cannot be reproduced. In order to overcome the restrictions, Navier-Stokes equation is applied to solve the ultrasound propagation. In the present work, it is assumed that the medium in HIFU treatment is water or liver. The unknown physical parameters which are not explicitly shown in the approximation equations, for example, shear and bulk viscosity, are set to reproduce absorption coefficient. The results of one-dimensional plane wave propagation show that the calculated absorption coefficient of the liver is 0.578 m^{-1}, which is almost equal to referenced value 0.574 m^{-1} when the ultrasound frequency is 200kHz. The results of the two-dimensional focused ultrasound propagation show that the ratio of negative peak pressure to positive peak pressure decreases with the increase of the transducer drive level. The maximum temperature rise increases and the location of the maximum temperature comes closer to the transducer, when the ratio of bulk viscosity to shear viscosity increases with a constant absorption coefficient.

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