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High Intensity Pressure Noise Transmission in Human Ear: A Three Dimensional Simulation Study[1] TAKUMI HAWA, RONG GAN, KEGAN LECKNESS, The University of Oklahoma — High intensity pressure noise generated by explosions and jet engines causes auditory damage and hearing loss of the military service personals, which are the most common disabilities in the veterans. Authors have investigated the high intensity pressure noise transmission from the ear canal to middle ear cavity. A fluid-structure interaction with a viscoelastic model for the tympanic membrane (TM) as well as the ossicular chain has been considered in the study. For the high intensity pressure simulation the geometry of the ear was based on a 3D finite element (FE) model of the human ear reported by Gan et al. (Ann Biomed Eng 2004). The model consists of the ear canal, TM, ossicular chain, and the middle ear cavity. The numerical approach includes two steps: 1) FE based finite-volume method simulation to compute pressure distributions in the ear canal and the middle ear cavity using CFX; and 2) FE modeling of TM and middle ear ossicles in response to high intensity sound using multi-physics analysis in ANSYS. The simulations provide the displacement of the TM/ossicular chain and the pressure fields in the ear canal and the middle ear cavity. These results are compared with human temporal bone experimental data obtained in our group.

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