

**ACOUSTICS2008/2595**  
**Effects of elastic properties on the wave propagation in cancellous  
bones - a simulation study -**

Yoshiki Nagatani<sup>a</sup>, Takashi Saeki<sup>b</sup>, Mami Matsukawa<sup>b</sup>, Takefumi Sakaguchi<sup>a</sup> and Hiroshi Hosoi<sup>a</sup>

<sup>a</sup>Nara Medical University, 840 Shijo-cho, 634-8522 Kashihara, Japan

<sup>b</sup>Doshisha University, 1-3, Tatara Miyakodani, 610-0321 Kyotanabe, Japan

For diagnosing osteoporosis, ultrasonic systems are considered a powerful tool, because ultrasonic waves strongly depend on the elasticity and structure of cancellous bones. We have reported the separation of longitudinal waves into fast and slow waves, a phenomenon that is strongly connected to the alignment of bone trabeculae. In order to understand this complicated wave propagation, we have simulated the wave propagations with the finite-difference time-domain (FDTD) method using three-dimensional X-ray CT images of actual cancellous bones. In this simulation, the effects of elastic properties in the solid portions are important. One idea is to adopt the experimentally observed ultrasonic properties of cortical bone. However, we should remind the possible problems like the elasticity difference between cancellous and cortical bones, individual differences, and anisotropy. In this study, then, we have investigated the influences of elastic properties, Poisson's ratio, and densities of solid portion (trabeculae). As a result, we confirmed that the small changes give strong influences on not only the wave speed but also the amplitudes of fast and slow waves. The influence on the amplitudes seems to come from the changes of acoustic impedance of trabeculae. The results show the importance of elastic properties in the simulation.