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Wave propagation in cancellous bone in terms of Biot's theory

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The paper is focused on modelling of wave propagation in cancellous bones using Biot's theory. Almost all required input mechanical and structural parameters for 31 pure femoral trabecular bone specimens were measured individually. Then frequency dependent wave parameters predicted by the model were compared with the results of ultrasonic tests performed on the same specimens. To compare the predictions to measurements, additional interactions of the plane harmonic wave with the slab of cancellous was considered. The most important finding is the significant contribution of the fluid/bone and bone/fluid boundaries on the global attenuation loss. The corrected values of attenuation coefficient are of the same order of magnitude compared to measured values. The theoretical results exhibit higher attenuation of fast wave compared to that of the slow wave in good agreement with experimental observations. Moreover the amplitude ratio of simulated time domain signals of both longitudinal waves (accordingly to the Biot's model with boundary corrections), are of the same order of magnitude compared to the amplitude ratio of experimental time records. However, an analysis in the frequency domain shows that the frequency content of the simulated pulses of the fast and slow wave differs from that observed in the experiments.