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Simulated response of the human lung to low-frequency underwater sound using a finite-element-based thoracic model

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In a previous paper, inhomogeneity within the lungs and its influence on the lung's response to low-frequency underwater sound using a finite-element-based model was discussed [Wochner, *et al.*, J. Acoust. Soc. Am. **122**, 2957 (2007)]. Here we report an extension of the previous work that adds surrounding organs to the finite element model. It is hypothesized that the significant damage that can occur at relatively low amplitudes when the lung is in resonance is due primarily to the shear stresses that can occur in the lung through its interactions with surrounding organs. In particular, the heart, diaphragm, and ribs, all of which have considerably different material properties compared to lung, may have a sizable effect on the lung's response to low-frequency underwater sound. This paper will discuss the resonance frequency, motion, and stress and strain fields produced using this new finite-element-based thoracic model. [Work supported by ONR and ARL:UT IR&D]