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**A fast FFT-based integral-equation solver for simulation of
elastoacoustic wave propagation in human head**

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We describe formulation, implementation, and representative applications of a fast integral-equation solver for modeling wave propagation in inhomogeneous visco-elastic and visco-acoustic media (e.g. in biological tissues).

The present approach is an extension of our work on fast integral equation solvers in pure acoustics. It is based on Lippmann-Schwinger (L-S) integral equations. It incorporates: (i) FFT-based compression of the stiffness matrix and the corresponding fast iterative method resulting in the solution complexity proportional to the number of unknowns, and ability to solve problems of several million unknowns, (ii) piecewise-linear basis functions supported on tetrahedra, representing displacement field, and corresponding efficient algorithms for evaluation of Galerkin matrix elements, (iii) rigorous two-stage solution scheme applicable to scatterers composed of high contrast materials and consisting of transforming the L-S equations into a system of two well-conditioned problems (conventional solution schemes, when applied to such scatterers, lead to stiffness matrix of large condition number).

We present applications of the developed approach to simulation of elastic wave propagation in realistic models of the human head, with the goal of comparing sound transmission through the normal auditory airways and through bone conduction, and in the presence and absence of noise-protective devices.

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