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Analysis of a vibrating structure as an airborne sound source by means of matrix inversion

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The decomposition of a complex airborne sound source into a number of simple sources has found wide applicationin transfer path analysis. One of the most advanced ways to solve this task is to use the matrix inversion method. This method works well for describing concentrated sources like monopoles. In practice, however, it is also desirable to analyze distributed sources such as a vibrating structure (e.g., the housing of an engine). A large number of gridpoints, representing emitting partial surfaces, and an even larger number of measurement points complicate the task. The large matrix of transfer functions between source points and measurement points that need to be inverted is often ill-conditioned. Mathematical approaches such as regularization techniques are required for the matrix inversion. Understanding the ways to apply these approaches and their physical meaning is one of the most important steps in finding suitable solutions to the mathematical inversion problem without losing physical information. In this paper, some of the most common matrix inversion strategies are analyzed for the example of a vibrating plate.