Simulation of sound waves (acoustic) by using the Finite Difference Time-Domain Method

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Abstract

Finite Difference Time Domain (FDTD) method belongs to the branch of wave-based acoustic modelling methods and it is successful in modeling accurately the diffraction and interference effects that are crucial for proper representation of the wave nature of sound, especially at low frequencies. In this paper, to study the behavior of sound waves in a closed environment of FDTD method was used. First wave equation using the laws of conservation of mass, momentum and the equation of state adiabatic for a compressible fluids ideal inference, then the equation boundary condition in a closed environment, using the law of conservation of momentum and the equation the impedance of the wall is obtained. Then the wave equation and boundary condition equations, the equations by finite difference time domain is discretized. Finally, the wave equation under the boundary condition wall with the desired absorption coefficient and initial condition impulsive sound source by using finite difference time domain has been resolved. Consistency of the results of the present method and the results of earlier work suggests that this method accurately simulates the propagation of sound waves is in a closed environment.

Key words: wave equation, finite difference time domain, acoustic, closed environment.

1. Introduction

In recent decades the enormous growth of industrial machinery, household appliances and other noises caused by the adverse impact it is no secret. Therefore, control and reduce unwanted noise, creates conditions suitable acoustic and acoustic comfort is inevitable. Achieve these goals only by fully understanding the propagation of sound waves and their behavior in the face of complex structures is possible. Sound wave propagation modeling methods are divided into two general categories: the geometrical methods and ways of solving wave equation.