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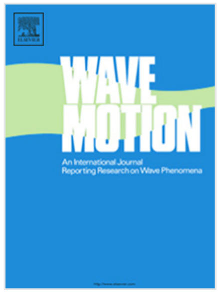

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Diffraction of a mode close to its cut-off by a transversal screen in a planar waveguide

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Abstract

The problem of diffraction of a waveguide mode by a thin Neumann screen is considered. The incident mode is assumed to have frequency close to the cut-off. The problem is reduced to a propagation problem on a branched surface and then is considered in the parabolic approximation. Using the embedding formula approach, the reflection and transmission coefficients are expressed through the directivities of the edge Green's function of the propagation problem. The asymptotics of the directivities of the edge Green's functions are constructed for the case of small gaps between the screen and the walls of the waveguide. As the result, the reflection and transmission coefficients are found. The validity of known asymptotics of these coefficients is studied.

1 Problem formulation and introductory notes

Consider a planar acoustic waveguide in the plane (x, y) composed of two acoustically hard walls located at $x = (b-a)/2$ and $x = (b+a)/2$ (see Fig. 1). The width of the waveguide is a; the position of the walls is chosen for convenience of computations. The Helmholtz equation

$$\Delta \tilde{u} + k^2 \tilde{u} = 0 \tag{1}$$

is fulfilled inside the waveguide by the total field $\tilde{u}$. The time dependence of the form $e^{-i\omega t}$ is omitted everywhere. The wavenumber k has a small positive