程式 34 Scattering by a screen

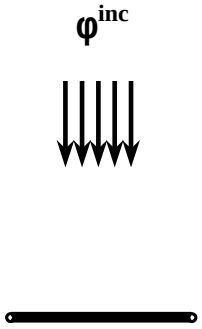

Fig.1(a) straight screen.

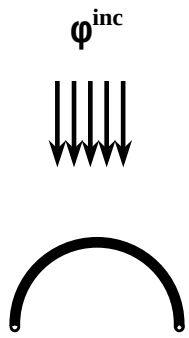

Fig.1(a) curve screen.

(1a) Scattering by a straight screen. (hard or soft scatter)
(1b) Scattering by a curve screen. (hard or soft scatter)

Exact solution

(1) The corresponding exact solution of the surface function for acoustically soft flat plate:

$$\frac{1}{k}\frac{\partial\phi(\nu)}{\partial n}=\frac{1}{\nu}\left(\frac{8\pi}{1-\tau^2}\right)^{1/2}\sum_{n=0}^{\infty}(-1)^n\left[\frac{Se_{2n}(\nu,0)Se_{2n}(\nu,\tau)}{N_{2n}^{(e)}Re_{2n}^{(3)}(\nu,1)}-i\frac{So_{2n+1}(\nu,0)Se_{2n+1}(\nu,\tau)}{N_{2n+1}^{(e)}Ro_{2n+1}^{(3)}(\nu,1)}\right],$$

where
$\phi(\nu)$ is surface field, $\nu=kd$, $0\le\nu<2\pi$,
Se and So are the Mathieu even and odd angular functions, respectively,
$Re^{(3)}$ and $Ro^{(3)}$ are the Mathieu even and odd radial functions of the third kind, respectively,
$N_i^{(e)}$ and $N_i^{(o)}$ are defined by the following orthogonal relations:

$$\int_0^{2\pi} Se_i(\nu,\cos\nu)Se_j(\nu,\cos\nu)d\nu=\begin{cases}0 & i\neq j,\\ N_i^{(e)} & i=j,\end{cases}$$

$$\int_0^{2\pi} So_i(\nu,\cos\nu)So_j(\nu,\cos\nu)d\nu=\begin{cases}0 & i\neq j,\\ N_i^{(o)} & i=j,\end{cases}$$

and

$$\int_0^{2\pi} Se_i(\nu,\cos\nu)So_j(\nu,\cos\nu)d\nu=0,\quad (i=j \text{ or } i\neq j)$$

(2) The corresponding exact solution of the surface function for acoustically hard flat plate:

$$\phi(\nu)=(8\pi)^{1/2}\sum_{n=0}^{\infty}(-1)^n\left[i\frac{Se_{2n}(\nu,0)Se_{2n}(\nu,\tau)}{N_{2n}^{(e)}\left(\partial/\partial u\right)Re_{2n}^{(3)}(\nu,\cosh u)\Big|_{u=0}}+\frac{So_{2n+1}(\nu,0)So_{2n+1}(\nu,\tau)}{N_{2n+1}^{(o)}\left(\partial/\partial u\right)Ro_{2n+1}^{(3)}(\nu,\cosh u)\Big|_{u=0}}\right],$$

where $0\le u<\infty$

Reference

(1) S. A. Yang, “A numerical method for scattering from acoustically soft and hard thin bodies in two dimensions”, 250(5), Journal of Sound and Vibration, pp.773-793 (2002).
(2) Richard S. St.Jhon, “The solution of hypersingular integral equations with applications in acoustics and fracture mechanics”, PhD. Dissertation Old Dominion University (1998).