程式 30 Scattering by a screen

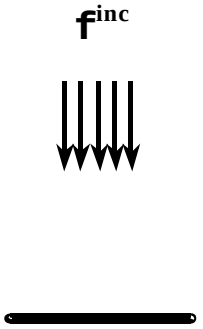

Fig.1(a) straight screen.

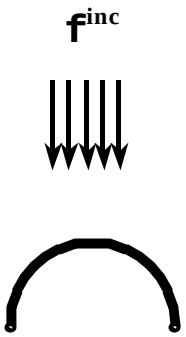

Fig.1(a) curve screen.

(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:

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

where

$f(n)$ is surface field, $n=kd$, $0\le n<2p$,

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:

$$\int_0^{2p} Se_i(n,\cos n)Se_j(n,\cos n)dn=\begin{cases}0 & i\ne j,\\ N_i^{(e)} & i=j,\end{cases}$$

$$\int_0^{2p} So_i(n,\cos n)So_j(n,\cos n)dn=\begin{cases}0 & i\ne j,\\ N_i^{(o)} & i=j,\end{cases}$$

and

$$\int_0^{2p} Se_i(n,\cos n)So_j(n,\cos n)dn=0,\quad (i=j \text{ or } i\ne j)$$

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

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

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).