

Resonance and focusing of an elliptical harbor by using the null-field BIEM

Jia-Wei Lee¹, and Jeng-Tzong Chen^{1,2}

¹**Department of Harbor and River Engineering, National Taiwan Ocean University
2 Pei-Ning Rd., Keelung, Taiwan**

²**Department of Mechanical and Mechatronic Engineering, National Taiwan Ocean
University
2 Pei-Ning Rd., Keelung, Taiwan
29952008@mail.ntou.edu.tw**

In this paper, the resonance of an elliptical harbor is studied by using the semi-analytical approach. The method is based on the null-field boundary integral equation method in conjunction with degenerate kernels and the eigenfunction expansions. The problem is decomposed into two regions by employing the concept of taking free body. One is an elliptical harbor, and the other is a problem of half-open sea with a coastline subject to the impermeable (Neumann) boundary condition. It is interesting to find that the SH wave impinging on the hill can be formulated to the same mathematical model. After finding the analogy between the harbor resonance and hill scattering, focusing of the water wave inside an elliptical harbor is also examined. Finally, several numerical examples of elliptical harbor problems with different opening entrances are used to verify the validity of the present formulation.

Keywords: harbor resonance, focusing, Helmholtz equation, degenerate kernel