

# **A new method of fundamental solutions for Helmholtz problem with simply-connected domain**

**\*Ying-Te Lee and Shyh-Rong Kuo**

Department of Harbor and River Engineering, National Taiwan Ocean University, Taiwan.

\*Presenting author: yilee@mail.ntou.edu.tw

## **Abstract**

In the conventional MFS, the point sources are always put on the artificial boundary where is outside of the physical domain to avoid singularity behavior. Here, we propose a new diagonal-terms capturing scheme for the Helmholtz problem with simply-connected domain. It is different from the conventional method of fundamental solution that the source points can be put on the real boundary in the proposed method. For the Helmholtz problem, when the source point and collocation points are located at the same position, the values of diagonal terms in the influence matrices are infinity. However, physically speaking, these values must be finite values. Here, we introduce the limiting formula of Hankel function for small argument connected with the successful approach of capturing diagonal terms for Laplace problems to determine the diagonal term values of the influence matrices for Helmholtz problem. This is an easy way, and the prominent features of the MFS are still maintained. Besides, the proposed scheme can be used not only for single-layer approach but also for the double-layer approach. Finally, several numerical examples are given to illustrate the feasibility, validity and accuracy of the proposed method.

**Keywords:** method of fundamental solutions, limiting formula for small argument, Helmholtz equation, meshless method, membrane vibration