

Application of Indirect Trefftz Boundary Method in Solving the Helmholtz Equation in 2D Finite Domain

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Trefftz method could be used at the boundary-type solution procedure using regular T-complete functions satisfying the governing equation. Until now, it has been mainly applied to numerical analyses of the problems governed with the homogeneous differential equations such as the two and three dimensional Laplace problems and the two dimensional elastic problem without body forces. One considerable advantage of the Trefftz method in comparison with the conventional BEM is that the integral equation is regular and no singular integral is required. In the Trefftz-type boundary solution method, smooth non-singular Trefftz complete solutions are used in formulations, therefore the results will generally be more accurate because of the ease in integrating the integral correctly. This paper describes the application of the indirect Trefftz method to the solution of the Helmholtz equation. The Helmholtz equation is frequently encountered in various fields of engineering and physics. The vibration of membranes and the water wave diffraction problems in offshore structural engineering are the two examples. Therefore, indirect formulation using complete and non-singular systems of Trefftz functions for the Helmholtz equation are posed in this paper. In the indirect formulation, the solution is approximated by superposition of the regular T-complete functions with unknown coefficients. Then, the unknown parameters are determined so that the approximate solution satisfies boundary conditions. The present scheme applies to some examples in order to examine the numerical properties. The numerical results indicate that a non-singular complete series solution can be obtained by the present method and the results show that the aforementioned method is effective for solving of Helmholtz equation.

Keywords: Indirect Trefftz method; Boundary-type solution; T-complete functions and Helmholtz equation.