A precise integration scheme in dual reciprocity boundary element method for transient problems

*†Fenglin Zhou[1], Yulong You[1], and Weijia Wang[1]

[1]College of Mechanical Engineering, Hunan University of Technology, China.

*Presenting author: edwal0zhou@163.com
†Corresponding author: edwal0zhou@163.com

Abstract

A dual reciprocity precise integration method (DRPIM) is presented to solve 3-dimensional transient problems including transient heat conduction and scalar wave propagation problem. In the presented method, the time dependent problem, which is usually classified into the initial boundary value problem, is transformed into an initial value problem (IVP) through a dual reciprocity scheme. Then an analytical solution, which is described by terms of the matrix exponential function (MEF), to the resulted IVP is applied. A precise integration method (PIM) is finally applied to compute the MEF accurately. In the implementation for transient heat conduction, the analytical solution to the corresponding IVP is applied. In the implementation for scalar wave propagation problems, the analytical solution to the corresponding IVP can not be obtained directly. An intermediate variable is introduced to transform the ordinary differential equation of the second order into two ordinary differential equations of the first order. Then the analytical solution to the resulted ordinary differential equations are applied. Four numerical examples are presented to illustrate the stability and accuracy of the method.

Keywords: dual reciprocity method, boundary element method, precise integration method, transient problems, time dependent problems