Section 07

Integral equations with approximate kernels

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Abstract

As a rule there is exact correspondence between boundary integral equation and partially differential equation, that is a solution of the first one is an exact analytical solution of the second one, if, of course, such solution exists and is unique. Such correspondence is based on fundamental solution, which is exact singular solution of differential equation. The case when approximate fundamental solution is built, because construction of exact fundamental solution is difficult, is considered in the present work. Consider an elliptical equation in slightly non-homogeneous media described, for example, stationary temperature field. Non-homogeneity may be connected with non-homogeneous properties of media or with nonlinear effects, that is, the properties of media depend on temperature. The term "slightly non-homogeneous" means, that non-homogeneous effects are sufficiently less than a main property quantity, which is assumed constant. In the present work approximate fundamental solution of slightly non-homogeneous equation is constructed by small parameter method. As a rule, first two or three terms of the expansion are assumed enough for high accuracy. However, how does error of fundamental solution influence on general boundary element method error. In order to check fundamental solution error influence, the problem with known analytical solution is chosen as a test problem. After that the fundamental solution is disturbed artificially by some enough small function. Several kinds of disturbing functions are considered. It cannot be considered as a proof, however proposed approach is applied to several test problems and good correspondence, which is shown in the calculations, confirms that the conclusions are correct.

Keywords: Boundary integral equations, Small parameter method, Fundamental solution, Disturbance