

Variants of Finite Element Method with Trefftz Base Functions for Solving Direct and Inverse Nonlinear Heat Conduction Problems

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In the paper different variants of Finite Element Method with Trefftz base function (FEMT) in solving nonlinear stationary heat conduction problems are considered. Both direct and boundary inverse problems can be solved employing this approach. Three variants of FEMT are examined: continuous (classical FEM with Trefftz base functions), non-continuous (Trefftz base functions without continuity in nodes) and node-less (substructuring - the domain is divided into subregions and in each of them the exact solution is approximated directly by linear combination of the Trefftz functions).

A nonlinear operator is decomposed into a linear and nonlinear part. The nonlinear part is treated as an inhomogeneity for the linear operator. Next, the Picard's iteration is used. In each iteration the Trefftz functions are used to solve the linear inhomogeneous problem. The sensitiveness of the method according to data disturbance has been checked.

Keywords: Trefftz functions, nonlinear heat conduction, inverse problems