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An improved implementation of triple reciprocity boundary element method for three-dimensional steady state heat conduction problems. (English) [Zbl 1464.80025](#)

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Summary: The domain integrals caused by heat generation appearing in the boundary integral equation (BIE) of steady state heat conduction problems can be converted into boundary integrals by triple reciprocity method (TRM). However, the current triple reciprocity approximation (TRA) of domain functions is time-consuming and its accuracy is not stable in different geometric models, due to the need to solve a combination equation, whose degree of freedom is twice the number of boundary nodes plus the number of domain interpolation points. Therefore, a new formula of TRA is proposed in the current study to save computing time and storage space and improve accuracy. In the new proposed TRA formula, the combination equation is transferred into three equations that are solved in sequence. Four numerical examples are presented to demonstrate the efficiency and accuracy of the proposed method. Results show that although the new TRA formulation is equivalent to the original one, the approximation results are quite different, especially for non-thin structures. Particularly, the improved formula of TRA can save computing time and storage space, and get better accuracy. The improved triple reciprocity BEM is a useful approach to analyze the three-dimensional steady heat conduction problems more efficiently and accurately.

MSC:

80M15 Boundary element methods applied to problems in thermodynamics and heat transfer

Cited in **5** Documents

65N38 Boundary element methods for boundary value problems involving PDEs

80A19 Diffusive and convective heat and mass transfer, heat flow

Keywords:

steady state heat conduction; boundary element method; triple reciprocity method

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