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The Boundary Element Method in Excel for Teaching Vector Calculus and Simulation

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Abstract : This paper discusses the implementation of the boundary element method (BEM) on an Excel spreadsheet and how it can be used in teaching vector calculus and simulation. There are two separate spreadheets, within which Laplace equation is solved by the BEM in two dimensions (LIBEM2) and axisymmetric three dimensions (LBEMA). The main algorithms are implemented in the associated programming language within Excel, Visual Basic for Applications (VBA). The BEM only requires a boundary mesh and hence it is a relatively accessible method. The BEM in the open spreadsheet environment is demonstrated as being useful as an aid to teaching and learning. The application of the BEM implemented on a spreadsheet for educational purposes in introductory vector calculus and simulation is explored. The development of assignment work is discussed, and sample results from student work are given. The spreadsheets were found to be useful tools in developing the students' understanding of vector calculus and in simulating heat conduction.

Keywords : boundary element method, Laplace's equation, vector calculus, simulation, education
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