NUMERICAL METHODS FOR DETERMINING TEMPERATURE DISTRIBUTION PATTERNS

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ABSTRACT

Temperature distribution is widely be used in engineering to obtain a visual spread of how temperature spreads at certain parts of the desired element. Temperature distribution patterns can be obtained by installing or employing a mesh on the element, the element can be analysed and by applying numerical solutions.

In order to obtain a temperature distribution figure, a study on heat transfer is done first to obtain the temperature within an element based on its surrounding or boundary temperature. By doing so, a mesh is being used where the intersection of the mesh is the node of which the temperature will be analysed. From there, the temperature distribution pattern can be plotted by means of software such as MATLAB.

Comparisons on various types of numerical methods and their discretisations are done theoretically and extra focus is paid to the finite difference method as the problem will be using the finite difference method to compute the results. In addition to that, analytical solutions are employed to provide a baseline result for the numerical solution. As for iterative methods such Jacobi, Gauss-Seidel iterations, Red-Black Gauss-Seidel method and multigrid, were being discussed theoretically.

Programming of the numerical solution program enables easy calculation of the finite difference method which is based on the Laplace equation in steady state. The programme also includes the size of mesh within a limited parameter of an element and the tolerance or convergence values are predetermined in the programme as they indirectly plays a part in the accuracy of the result.

The problem is based on a two dimensional square domain with fixed boundary conditions. Certain conditions must be met in order to use the steady state Laplace equation such as steady heat transfer, no internal heat generation and a constant thermal conductivity. Results are gathered and conclusions are made based on observation and graphical analysis.