ABSTRACT

The Monte Carlo method has previously been used to solve nonhomogeneous steady-state heat conduction equations having boundary conditions of the first kind, the second kind, and the third kind and homogeneous unsteady-state heat conduction equations having boundary condition of the first kind. In this research, the Monte Carlo method is further developed to enable it to solve nonhomogeneous unsteady-state heat conduction equations having boundary condition of the first kind, the second kind, and the third kind. The solution is expressed in terms of transition probabilities. Moreover, the generalization of the Monte Carlo method is found to be the Exodus method, which yields the solution in terms of Exodus functions. The Exodus method is shown to be able to solve problems having space-dependent density, heat capacity, and thermal conductivity. Unlike the Monte method, the Exodus method can deal with problems that employ backward time-differencing or central time-differencing, which means that the general finite-element formulation of a general linear heat conduction problem can be solved by the Exodus method. General partial differential equations, not just the heat conduction equation, can also be solved with the Exodus method if an appropriate formulation of the problem is used. The Monte Carlo method and the Exodus method have an advantage over other numerical methods in that they allows the determination of the temperature at a specific location without having to solve for the solution of the entire domain. Therefore, the determination of sensitivity coefficients will be efficient with the use of the Exodus method or the Monte Carlo method.