

FAST TRANSIENT THERMAL ANALYSIS OF FOURIER AND NON-FOURIER HEAT CONDUCTION

Abstract

In this paper, asymptotic waveform evaluation (AWE) has been successfully used for fast transient characterization of Fourier and non-Fourier heat conduction. The Fourier and non-Fourier equations are reduced to a system of linear differential equations, respectively, using finite element method and then solved with AWE. Besides providing equivalent accuracy in its solution, it is also shown that AWE is at least three orders faster in term of computational time as compared to conventional iterative solvers. Its accuracy is also independent of the time step used and it has the capability of providing local transient solution. However, the moment matching process in AWE is inherently ill-conditioned and thus may yield unstable response even for stable system. This numerical instability is addressed and two stability schemes are also successfully implemented to yield stable and accurate solutions from AWE. The limitation of AWE is also discussed.