A comprehensive comparison between wave propagation and heat distribution via analytical solutions and computer simulations

ABSTRACT

Wave propagation and heat distribution are both governed by second order linear constant coefficient partial differential equations, however their solutions yields very different properties. This study presents a comprehensive comparison between hyperbolic wave equation and parabolic heat equation. Issues such as conservation of wave profile versus averaging, transporting information, finite versus infinite speed propagation, time reversibility versus irreversibility and propagation of singularities versus instantaneous smoothing have been addressed and followed by examples and graphical evidences from computer simulations to support the arguments.

Keyword: Heat distribution; Hyperbolic and parabolic partial differential equation; Wave propagation