

Finite difference method for the 2D heat equation with concentrated capacity

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Abstract

One interesting class of parabolic problems model processes in heat-conduction media with concentrated capacity in which the heat capacity coefficient contains a Dirac delta function. Such problems are nonstandard and the classical tools of the theory of finite difference schemes are difficult to apply to their convergence analysis. In the present paper a finite-difference scheme, approximating the two-dimensional initial-boundary value problem for the heat equation with concentrated capacity and time dependent coefficients of the space derivatives, is derived. Abstract operator method is developed for analyzing this problem. Convergence in special discrete $W_2^{2,1}$ and $W_2^{1,1/2}$ anisotropic Sobolev norms is proved.

Keywords: Partial differential equations, Delta function, Sobolev norm, Convergence.

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