Partial Differential Equations

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Preface

This material is taken from "Schaum's Outline of Theory and Problems of Partial Differential Equations" by Paul DuChateau and David W. Zachmann. The footnotes are taken from content gathered from Wikipedia.

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Chapter 1

Difference Methods for Parabolic Equations

1.1 Difference Equations

The various partial derivatives of a function $u(x,t)$ can be expressed as a *difference quotient* plus a truncation error (T.E.).

$$u_t(x,t) = \frac{u(x,t+k) - u(x,t)}{k} + \text{T.E.} \tag{1.1}$$

$$\text{T.E.} = -\frac{k}{2}u_{tt}(x,\bar{t}) \quad (t < \bar{t} < t+k) \qquad \text{(Forward Difference for } u_t\text{)}$$

Chapter 2

Difference Methods for Hyperbolic Equations

2.1 One-Dimensional Wave Equation

Methods similar to those given in Section 9.4 may be used to approximate smooth solutions to

$$u_{tt} = c^2 u_{xx} \qquad\qquad (2.1)$$

Let $(x_n, t_j) = (nh, jk)$ $(n, j = 0, 1, 2, \dots)$ and write $s \equiv k/h$; we have as representatives of the two sorts of methods: