

Final Exam

Cliff Sun

April 30, 2024

Intro to Partial Differential Equations

1. What is a PDE? (order and linear)
2. Important PDEs - first order, linear PDE (characteristic curves, change of variables)
3. Heat Equation (Half line extension, heat kernel, with source (piecewise or continuous))
4. Wave Equation (weak initial conditions, with source (piecewise or continuous))
5. Laplace Equation (coefficients for Fourier Series, how to solve in cartesian and polar)

We care about their solutions in the explicit and implicit form. Like for the heat equation, its explicit solution is

$$u(x, t) = \int_{-\infty}^{\infty} S(x - y, t) \phi(y) dy \quad (1)$$

We mostly care about the explicit form in this class.

Methods for solving

1. Characteristic lines/curve
2. Change of variables
3. Separation of variables
4. Fourier Series (polar series and convergence theorem)
5. Fourier transform (properties of it, convolution theorem, etc., don't need table)

Misc stuff

1. Fourier Convergence
2. Parseval's Equality (for both full and partial, don't forget to multiply by length)
3. Maximum Principle
4. Laplacian Invariance
5. Comparison Principle

Not Covered

1. Spherical Harmonics
2. Principle of Causality
3. Conservation of Energy