MATHEMATICAL PHYSICS: A COMPLETE GUIDE

PHYS 435

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Solo Pursuit of Learning



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Part I Complex Analysis

Properties of Complex Functions

- 1.1.0 Elementary Definitions
- 1.2.0 Multivalued Functions and Branch Cuts
- **1.3.0** Analytic Functions and the Cauchy-Riemann Equations
- 1.4.0 Singularities and Zeros
- 1.5.0 Conformal Mappings

Power Series and Laurent Series

- 2.1.0 Power Series Fundamentals
- 2.2.0 Laurent Series
- **2.3.0** Series Operations

Complex Integration

- 3.1.0 Complex Integral
- 3.2.0 Cauchy's Theorems
- 3.3.0 Residue Theorem
- 3.4.0 Contour Integrals

Applications of Complex Functions

- 4.1.0 Complex Potentials
- 4.2.0 Finding Zeros
- 4.3.0 Inverse Laplace
- 4.4.0 Stokes' Equations and Airy Integrals
- 4.5.0 WKB Methods, and Integral Approximations

Part II

PDEs

General and Particular Solutions

- **5.1.0** Important Examples and Motivation
- **5.2.0** General Forms of Solutions
- **5.3.0** Wave and Diffusion Equations
- **5.4.0** Existence and Uniqueness

Fourier Series

- **6.1.0** Initial Definitions and Dirichlet Conditions
- **6.2.0** Symmetry Conditions
- 6.3.0 Discontinuous and Non-Periodic Functions
- **6.4.0** Integration and Differentiation
- 6.5.0 Complex Fourier Series

Separation of Variables and Other Methods

- 7.1.0 Separation of Variables
- 7.2.0 Integral Transforms
- 7.3.0 Inhomogeneous Problems

Appendices