

Differential Equations

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October 2, 2021

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Part I

Linear ordinary differential equations

Chapter 1

Constant coefficient equations

1.1 Characteristic equations

1.2 Complex roots

1.3 Repeated roots

Chapter 2

Non-constant coefficient equations

2.1 Series solution

2.2 Orthogonal polynomials

2.3 The Frobenius method

2.4 Fuch's theorem

Chapter 3

Inhomogeneous equations

3.1 Method of undetermined coefficients

3.2 Variation of parameters

3.3 Damped oscillation

3.4 The Laplace transform

Chapter 4

Sturm-Liouville theory

Part II

Nonlinear ordinary differential equations

Chapter 5

Nonlinear ordinary differential equations

5.1 The Picard-Lindelöf theorem

5.2 Integrating factors

Chapter 6

Dynamical systems

Equilibria and bifurcations

Stability theory

Hamiltonian systems

Chapter 7

Dynamical systems

7.1 Planar dynamical systems

Examples from ecology, electrical engineering
Poincaré-Bendixon

7.2 Hamiltonian systems

Chapter 8

Chaos

Attractors

Part III

Partial differential equations

Chapter 9

First order partial differential equations

Chapter 10

Laplace's equation

Chapter 11

Heat equation

Chapter 12

Wave equation