

## Description

This book is designed to introduce differential geometry to beginning graduate students as well as advanced undergraduate students. In the last couple of decades, differential geometry, along with other branches of mathematics, has been highly developed. In this book we will study only the traditional topics, namely, curves and surfaces in a three-dimensional Euclidean space  $E^3$ . Unlike most classical books on the subject, however, more attention is paid here to the relationships between local and global properties, as opposed to local properties only. Although we restrict our attention to curves and surfaces in  $E^3$ , most global theorems for curves and surfaces in this book can be extended to either higher dimensional spaces or more general curves and surfaces or both. Moreover, geometric interpretations are given along with analytic expressions. This will enable students to make use of geometric intuition, which is a precious tool for studying geometry and related problems; such a tool is seldom encountered in other

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## A First Course in Differential Geometry

### Chapter 1, Euclidean Spaces

1. PointSets
2. Differentiation and Integration
3. Vectors
4. Mappings
5. Linear Groups
6. Differential Forms
7. The Calculus of Variations

### Chapter 2, Curves

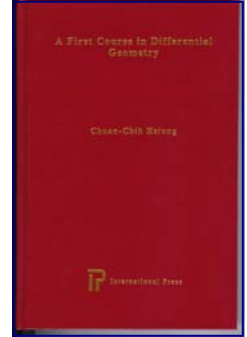
1. General Local Theory
2. Plane Curves
3. Global Theorems for Space Curves

### Chapter 3, Local Theory of Surfaces

1. Parametrizations
2. Functions and Fundamental Forms
3. Form of a Surface in a Neighborhood of a Point
4. Principal Curvatures, Asymptotic Curves, and Conjugate Directions
5. Mapping of Surfaces
6. Triply Orthogonal Systems, and the Theorems of Dupin and Liouville
7. Fundamental Equations
8. Ruled Surfaces and Minimal Surfaces
9. Levi-Civita Parallelism
10. Geodesics

### Chapter 4, Global Theory of Surfaces

1. Orientation of Surfaces
2. Surfaces of Constant Gaussian Curvature
3. The Gauss-Bonnet Formula
4. Exterior Differential Forms and a Uniqueness Theorem for Surfaces
5. Rigidity of Convex Surfaces and Minkowski's Formulas and Christoffel's Problems
6. Complete Surfaces



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### Table of Contents

1. Review and Introduction of Contents
2. First-Order PDEs
3. The Heat Equation
4. Fourier Series and Sturm-Liouville Theory
5. The Wave Equation
6. Laplace's Equation
7. Fourier Transforms
8. Numerical Solutions of PDEs - An Introduction
9. PDEs in Higher Dimensions

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 G. Csordas  
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## Basic Partial Differential Equations

### Table of Contents

#### Some unique features of this volume:

For students with three semesters of calculus, this book is self-contained. In particular, Section 1.1 contains a complete treatment of the relevant types of ordinary differential equations. No previous course in ordinary differential equations or linear algebra is necessary. There are approximately 280 examples worked out in detail, and 600 exercises ranging from routine to challenging. Answers to selected problems appear in the back of the book. Rigorous proofs of nearly all results used are given after ample physical motivation. The book documents extensive applications, including:

- heat conduction
- wave propagation
- vibrations of strings, square drums, round drums, spheres and manifolds
- traffic flow shocks
- evolution of population densities
- fluid flow
- electrostatics
- minimal surfaces
- gravitation
- quantum mechanics (including the determination of the bound states of the hydrogen atom)

Convenient summaries appear at the end of each section. Theorems and definitions are clearly off-set in boxes. The book contains 97 figures, illustrations and tables (graphs of mathematical functions of one or several variables were computer generated.) There are a number of brief historical and bio-

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