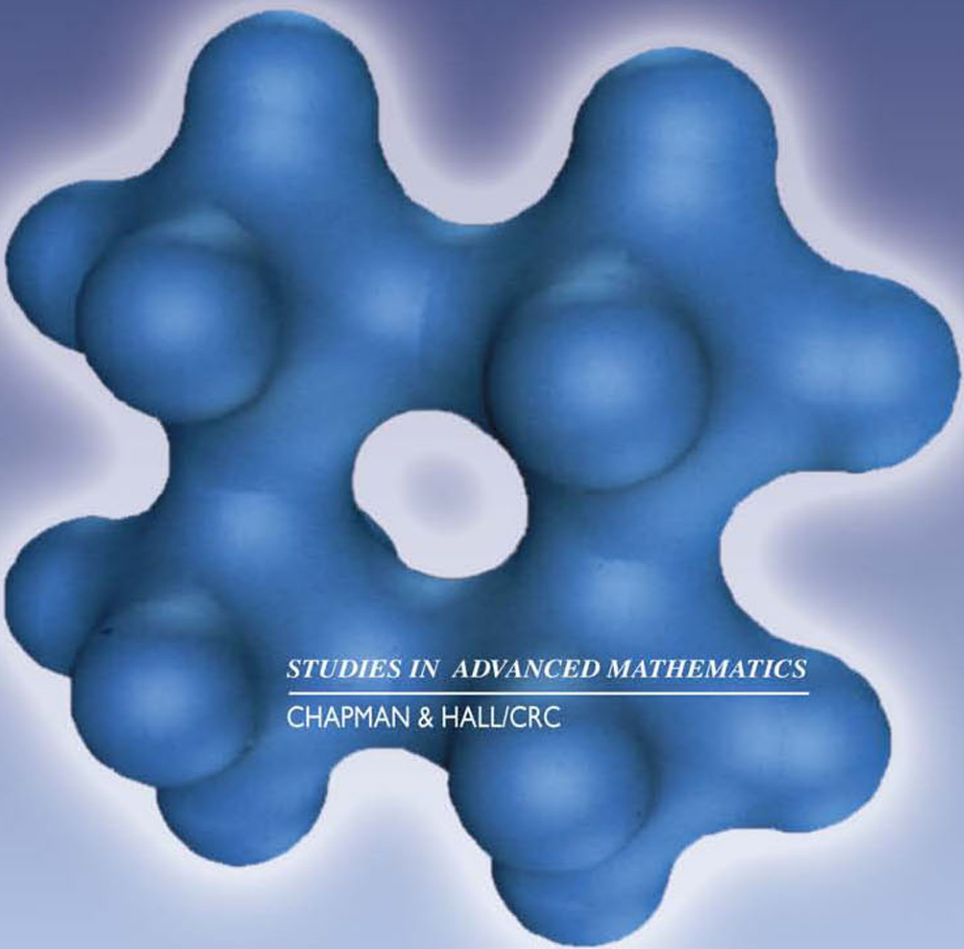
Keith Burns
Marian Gidea

Differential Geometry and Topology

With a View to Dynamical Systems



STUDIES IN ADVANCED MATHEMATICS

CHAPMAN & HALL/CRC

Differential Geometry and Topology

With a View to Dynamical Systems

Studies in Advanced Mathematics

Titles Included in the Series

John P. D'Angelo, Several Complex Variables and the Geometry of Real Hypersurfaces

Steven R. Bell, The Cauchy Transform, Potential Theory, and Conformal Mapping

John J. Benedetto, Harmonic Analysis and Applications

John J. Benedetto and Michael W. Frazier, Wavelets: Mathematics and Applications

Albert Boggess, CR Manifolds and the Tangential Cauchy–Riemann Complex

Keith Burns and Marian Gidea, Differential Geometry and Topology: With a View to Dynamical Systems

Goong Chen and Jianxin Zhou, Vibration and Damping in Distributed Systems
Vol. 1: Analysis, Estimation, Attenuation, and Design
Vol. 2: WKB and Wave Methods, Visualization, and Experimentation

Carl C. Cowen and Barbara D. MacCluer, Composition Operators on Spaces of Analytic Functions

Jewgeni H. Dshalalow, Real Analysis: An Introduction to the Theory of Real Functions and Integration

Dean G. Duffy, Advanced Engineering Mathematics with MATLAB®, 2nd Edition

Dean G. Duffy, Green's Functions with Applications

Lawrence C. Evans and Ronald F. Gariepy, Measure Theory and Fine Properties of Functions

Gerald B. Folland, A Course in Abstract Harmonic Analysis

José García-Cuerva, Eugenio Hernández, Fernando Soria, and José-Luis Torrea,
Fourier Analysis and Partial Differential Equations

Peter B. Gilkey, Invariance Theory, the Heat Equation, and the Atiyah-Singer Index Theorem,
2nd Edition

Peter B. Gilkey, John V. Leahy, and Jeonghueong Park, Spectral Geometry, Riemannian Submersions,
and the Gromov-Lawson Conjecture

Alfred Gray, Modern Differential Geometry of Curves and Surfaces with Mathematica, 2nd Edition

Eugenio Hernández and Guido Weiss, A First Course on Wavelets

Kenneth B. Howell, Principles of Fourier Analysis

Steven G. Krantz, The Elements of Advanced Mathematics, Second Edition

Steven G. Krantz, Partial Differential Equations and Complex Analysis

Steven G. Krantz, Real Analysis and Foundations, Second Edition

Kenneth L. Kuttler, Modern Analysis

Michael Pedersen, Functional Analysis in Applied Mathematics and Engineering

Clark Robinson, Dynamical Systems: Stability, Symbolic Dynamics, and Chaos, 2nd Edition

John Ryan, Clifford Algebras in Analysis and Related Topics

John Scherk, Algebra: A Computational Introduction

Pavel Šolín, Karel Segeth, and Ivo Doležel, High-Order Finite Element Method

André Unterberger and Harald Upmeier, Pseudodifferential Analysis on Symmetric Cones

James S. Walker, Fast Fourier Transforms, 2nd Edition

James S. Walker, A Primer on Wavelets and Their Scientific Applications

Gilbert G. Walter and Xiaoping Shen, Wavelets and Other Orthogonal Systems, Second Edition

Nik Weaver, Mathematical Quantization

Kehe Zhu, An Introduction to Operator Algebras

Differential Geometry and Topology

With a View to Dynamical Systems

Keith Burns
Northwestern University
Evanston, Illinois, USA

Marian Gidea
Northeastern Illinois Univeristy,
Chicago, USA

Chapman & Hall/CRC
Taylor & Francis Group
Boca Raton London New York Singapore

To Peter, Sonya and Imke – K.B.

To Claudia – M.G.

Preface

This book grew out of notes from a differential geometry course taught by the second author at Northwestern University. It aims to provide an introduction, at the level of a beginning graduate student, to differential topology and Riemannian geometry. The theory of differentiable dynamics has close relations to these subjects. We introduce basic concepts from dynamical systems and try to emphasize interactions of dynamics, geometry and topology.

We have attempted to introduce important concepts by intuitive discussions or suggestive examples and to follow them by significant applications, especially those related to dynamics. Where this is beyond the scope of the book, we have tried to provide references to the literature.

We have not attempted to give a comprehensive introduction to dynamical systems as this would have required a much longer book. The reader who wishes to learn more about dynamical systems should turn to one of the textbooks in that area. Three excellent recent books, with different emphases, are the texts by Brin and Stuck (2002), by Katok and Hasselblatt (1995), and by Robinson (1998).

The illustrations in this book were produced with Adobe Illustrator, DPGraph, Dynamics Solver, Maple, and Sierpinski Curve Generator. We thank Victor Donnay, Josep Masdemont, and John M. Sullivan for permission to reproduce some of the illustrations.

Contents