

# Preface

This text grew out of notes designed to prepare second-year undergraduate students, primarily mathematics majors, to work on introductory research projects in mathematics. Most of these projects were under the auspices of the Louis Stokes Alliance for Minority Participation at Bronx Community College, City University of New York.

As such, the text has two distinct parts. The first three chapters are introductory, and should be seen as “everything one would need to know” to understand a modern approach to differential geometry. The second part of the book is the core of the text, and showcases three geometric structures that are all prominent areas of current mathematical research. It is a hallmark of this text to present the three together in an introductory way.

There are several conceivable approaches to this text, depending on the level of the class. To cover the entire text in detail, presupposing only minimal exposure to matrix algebra and multivariable calculus, could take two semesters. For that reason, in a one-semester differential geometry class, I recommend a quick review of Chap. 2 (focused on Sects. 2.8–2.10) and Chap. 3, followed by a more careful treatment of Chap. 4, especially Sect. 4.7. This leaves time for approximately three weeks for each of Chaps. 5–7. The student who completes this regimen should have a good sense of differential geometry as the study of smoothly varying tensor structures on the tangent bundle. Alternatively, an instructor might choose to spend more time on Chap. 3, supplementing the text with a more rigorous treatment of the inverse and implicit function theorems, and then focusing on just one or two of the geometric structures later in the text.

The price of the early introduction to geometric structures presented here is that it is purely “local.” As mentioned throughout the text, the text stops short of introducing manifolds, and has downplayed the role of topology significantly. I hope that the treatment here provides firm preparation to take the steps in that direction.

I thank the colleagues who have helped me in proofreading, with the usual caveat that all remaining errors are mine alone: Quanlei Fang, Michael Harrison, Alexander Kheyfits, Mohamed Messaoudene, Cormac O’Sullivan, Philippe Rukimbira, and Anthony Weaver. Prof. Fang also provided helpful guidance in creating figures

in  $\text{\LaTeX}$ . Prof. Augustin Banyaga and Prof. Dusa McDuff provided welcome encouragement (not to mention inspiration!) at various stages of the project.

I thank the editorial team at Springer, especially Kaitlin Leach and the reviewers, for their patience and helpful guidance in seeing this text through.

Finally, I would like to give special thanks to the many students who have in one way or another encouraged me to write this text: Christian Castillo, Aliou Diop, Linus Mensah, Rosario Tate, Stephany Soria, Raysa Martinez, Aida Wade, Feraz Mohamed, Frances Villar, Mandie Solo, Jean Yao, and Keysi Peralta, to mention only a few. My MTH 35 class in Fall 2012 helped me reshape parts of the first three chapters; Dorian Whyte was especially helpful in proofreading. Without these students, this text would not have come to be.

Bronx, NY

Andrew McInerney

<http://www.springer.com/978-1-4614-7731-0>

First Steps in Differential Geometry

Riemannian, Contact, Symplectic

McInerney, A.

2013, XIII, 410 p. 54 illus., 25 illus. in color., Hardcover

ISBN: 978-1-4614-7731-0