

Preface

This small book is the outgrowth of notes for a mini-course delivered at the International Centre for Mathematical Sciences (ICMS) workshop on Differential Geometry and Continuum Mechanics held in Edinburgh in June 2013. The audience consisted mainly of mathematicians, engineers and physicists specializing in the main topic of the workshop. They hardly needed an introductory course on differential geometry, but the presence of several graduate students and the always pleasant feeling of the experts sitting comfortably back and listening to what they already know served to assuage any feelings of guilt or embarrassment that I may have felt at the outset.

Having been trained as an engineer, my great love in mathematics is differential geometry. Nowhere else in mathematics do I feel so much at freedom to improvise, sometimes incorrectly, but never too far from the truth. More than any other field, geometry is guided by an aesthetic ideal. There is in this ideal a tacit hope that what is true and good must also be beautiful, symmetric, well balanced. It is this perception that has guided all my activities and that I have tried to convey in these notes. Although keeping to the necessary precision required by any mathematical treatment, essence rather than rigour is the dominant feature of the presentation. To emphasize the richness of ideas almost immediately applicable to physical contexts, I decided to organize the material in a somewhat non-standard fashion, ascending first rather fast to increasingly complex algebraic and topological structures without involving differentiability. This approach allows me to talk about manifolds, topological groups, fibre bundles and groupoids and their physical applications in a qualitative manner invoking only topological concepts. This material occupies the first two chapters. The last two chapters are addressed to the survivors of the first two. It is hoped that the motivation will be by then strong enough to endure the details brought about by the differential structure.

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Differential Geometry

Basic Notions and Physical Examples

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