including an extract from Riemann's private notes showing his remarkable anticipation of the Bianchi identity.

I thoroughly enjoyed reading this book. The author's constant concern not to lose his readers keeps you going, and I am sure that even seasoned geometers will find fresh insights, new visualisations, and much inspiration from the way the topics are shaped and organised. Sadly, Needham acknowledges, "This is my second book, and it is also my last book." From the very personal account of the effort involved, they both represent extended labours of love exemplifying his overarching philosophy, that (p. 158) "… direct, geometric reasoning frequently allows us to completely bypass symbolic manipulation to obtain an intuitive, visual grasp of mathematical reality".

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Introduction to differential geometry by Joel W. Robbin and Dietmar A. Salamon, pp 418, £54.99 (paper), ISBN 978-3-662-64339-6, also available as e-book, Springer Studium Mathematik (Master) (2022)

As the series title suggests, this is a graduate level introduction to differential geometry, assuming a sound knowledge of calculus of several variables and linear algebra as well as a hefty dose of mathematical maturity. Alternatively it could be a 'second course' in differential geometry, following on from a more gentle undergraduate course based on, say, Barrett O'Neill's famous *Elementary Differential Geometry* (Academic Press, second edition 1997). The book is based on one-semester courses at ETH in Switzerland and at the University of Wisconsin-Madison in the USA and these will have been quite demanding courses. There is a fair amount of optional material, mainly in the area of intrinsic differential geometry (not assuming surfaces and other manifolds are embedded in Euclidean space), but even so there is a lot of very detailed work here. The final chapter is also optional and covers some very interesting topics which can be understood at this stage, such as the Morse index, isometries of compact Lie groups and semisimple Lie algebras.

The inclusion, for those interested, of intrinsic geometry alongside extrinsic—that is, where it is assumed manifolds are embedded in Euclidean space—is a significant virtue. The book is also thorough, providing background material, results and proofs as well as a steady development of the main material. This is fairly standard: submanifolds of Euclidean space, tangent spaces, vector fields, Lie groups and diffeomorphisms, vector bundles, connections, geodesics and curvature. The presentation is succinct (it is definitely a Master's level book) and there are very few pictures! This does not preclude helpful visual examples, such as sliding and rolling of train wheels, and a sphere rolling on a plane. (Neither sliding, nor rolling nor the next topics, twisting and wobbling, are listed as such in the Index, though you can find three of them under 'Motion'.) So, as an advanced introduction or second pass, as a reference resource, and as a prelude to further more abstract study, this is a fine addition to the differential geometry literature.

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