



# Geometrical Methods of Mathematical Physics

By Bernard F. Schutz

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In recent years the methods of modern differential geometry have become of considerable importance in theoretical physics and have found application in relativity and cosmology, high-energy physics and field theory, thermodynamics, fluid dynamics and mechanics. This textbook provides an introduction to these methods - in particular Lie derivatives, Lie groups and differential forms - and covers their extensive applications to theoretical physics. The reader is assumed to have some familiarity with advanced calculus, linear algebra and a little elementary operator theory. The advanced physics undergraduate should therefore find the presentation quite accessible. This account will prove valuable for those with backgrounds in physics and applied mathematics who desire an introduction to the subject. Having studied the book, the reader will be able to comprehend research papers that use this mathematics and follow more advanced pure-mathematical expositions.

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### Review

"...excellent. It would require a great deal of delving in the literature to produce equivalent treatments....a very useful introduction...." J. M. Stewart, Journal of Fluid Mechanics

"...Schutz has such a mastery of the material that it soon becomes clear that one is in authoritative hands....this book is the most lucid I have come across at this level of exposition. It is eminently suitable for a graduate course (indeed, the more academically able undergraduates should be able to cope with most of it), and the applications should suffice to persuade any physicist or applied mathematician of its importance." Ray d'Inverno, Times Higher Education Supplement

### About the Author

Bernard Schutz has done research and teaching in general relativity and especially its applications in astronomy since 1970. He is the author of more than 200 publications, including *A First Course in General Relativity and Gravity from the Ground Up* (both published by Cambridge University Press). Schutz currently specialises in gravitational wave research, studying the theory of potential sources and designing new methods for analysing the data from current and planned detectors. He is a member of most of the current large-scale gravitational wave projects: GEO600 (of which he is a PI), the LIGO Scientific Collaboration, and LISA. Schutz is a Director of the Max Planck Institute for Gravitational Physics, also known as the Albert Einstein Institute (AEI), in Potsdam, Germany. He holds a part-time chair in Physics and Astronomy at Cardiff University, Wales, as well as honorary professorships at Potsdam and Hanover universities in Germany. Educated in the USA, he taught physics and astronomy for twenty years at Cardiff before moving to Germany in 1995 to the newly-founded AEI. In 1998 he founded the open-access online journal *Living Reviews in Relativity*. The *Living Reviews* family now includes six journals. In 2006 he was awarded the Amaldi Gold Medal of the Italian Society for Gravitation (SIGRAV), and in 2011 he received an honorary DSc from the University of Glasgow. He is a Fellow of the American Physical Society and the Institute of Physics, an Honorary Fellow of the Royal Astronomical Society, and a member of the Learned Society of Wales, the German Academy of Natural Sciences Leopoldina and the Royal Society of Arts and Sciences, Uppsala.

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