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BOOK REVIEW

Differential Geometry and Lie Groups for Physicists, by Marian Fecko, Cambridge University Press, Cambridge, 2006, xv + 697 pp. ISBN 978-0-521-84507-6

A modern mathematical physicist could hardly imagine doing serious studies in the frame of contemporary theoretical and mathematical physics without making substantial use of concepts like vector and tensor fields, differential forms, Stokes theorem on manifolds, Lie derivative and symmetries, Lie (super)groups and Lie (super)algebras and their representations, bundles with connection, curvature and Chern classes, Hamiltonian and Poisson structures, Frobenius integrability. Differential topology has already also made serious steps inside theoretical physics through topological charges, helicity properties of magnetic fields in studying plasma properties, topological soliton theory and other homology/cohomology characteristics of physical systems wherever they are available and important. Any physical system has spatial structure and shows definite stability properties, so, it can support its existence and compensate in definite degree the external disturbances through appropriate shape changes and kinematical behavior without losing identity. Shortly speaking, its time existence is a dynamical process being strongly connected with various and continuous internal and external energy-momentum exchange processes. All these processes are real phenomena and any attempt for their description should be based on appropriate mathematical structures. The more than a century intensive interaction between differential geometry and Lie group theory on one hand, and the theoretical and mathematical physics, on the other hand, turned out to be exclusively useful, suggestive and creative process. The author of the book under review has very successfully and in a very appropriate way presented the idea that mathematics is not just abstract thinking and physics is not just working in labs. It could be said that physics has always stimulated mathematics to develop new branches, and mathematics has always been very responsive and warm-hearted to the needs of physics. Starting with Newton and Leibniz the greatest mathematicians of all times have contributed considerably to deeply understanding and solving difficult physical problems.