Géométrie

Pascal DUPONT. — **Introduction à la géométrie: géométrie linéaire & géométrie différentielle.** — Préface de Marcel Berger. — Un vol. broché, 18×25, de 691 p. — ISBN 2-8041-4072-5. — Prix: €64.95. — De Boeck Université, Bruxelles, 2002, diffusé par Servidis, Lonay, Suisse.

Destiné aux étudiants et aux professeurs du premier cycle en sciences mathématiques et physiques, cet ouvrage présente trois importantes structures géométriques: espaces affines, espaces euclidiens, espace projectifs et quatre types d'êtres géométriques fondamentaux: quadriques, courbes, surfaces, arcs riemanniens. Les trois premiers chapitres abordent, entre autres thèmes, les sous-espaces, les transformations préservant la structure, l'introduction des coordonnées. D'autres sujets évoqués sont les barycentres, les similitudes, les produits mixte et vectoriel, les coordonnées sphériques, le principe de dualité, le birapport... le chapitre 4 étudie les quadriques d'un point de vue affine d'abord, euclidien ensuite, projectif enfin. Une attention particulière est accordée aux coniques ainsi qu'aux quadriques de l'espace tridimensionnel. Dans les trois derniers chapitres, le principal outil de travail est le calcul différentiel. Courbes et surfaces sont étudiées d'abord pour leurs propriétés affines (tangentes ou plan tangent, asymptotes, enveloppes...) et ensuite pour leurs propriétés métriques (longueur ou aire, normale, courbure(s)...). L'objectif du dernier chapitre est, non pas véritablement d'introduire la géométrie riemannienne, mais de familiariser le lecteur à son langage et à son mode de pensée. Chaque notion est illustrée de multiples exemples et contre-exemples. Plus de 600 exercices et problèmes sont proposés, la plupart avec solutions.

Géométrie différentielle

Michèle AUDIN, Ana CANNAS DA SILVA, Eugen LERMAN. — **Symplectic geometry of integrable Hamiltonian systems.** — Advanced courses in mathematics, CRM Barcelona. — Un vol. broché, 17×24, de x, 225 p. — ISBN 3-7643-2167-9. — Prix: SFr. 48.00. — Birkhäuser, Basel, 2003.

Among all the Hamiltonian systems, the *integrable* ones – those which have many conserved quantities – have special geometric properties; in particular, their solutions are very regular and quasi-periodic. The quasi-periodicity of the solutions of an integrable system is a result of the fact that the system is invariant under a (semi-global) torus action. It is thus natural to investigate the symplectic manifolds that can be endowed with a (global) torus action. This leads to symplectic toric manifolds which are examples of extremely symmetric Hamiltonian systems. Physics makes a surprising come-back to describe mirror symmetry, one looks for a special kinds of Lagrangian submanifolds and integrable systems, the special Lagrangians. Furthermore, integrable Hamiltonian systems on punctured cotangent bundles are a starting point for the study of contact toric manifolds (part C of this book). Along the way, tools from many different areas of mathematics are brought to bear on the questions at hand, in particular, actions of Lie groups in symplectic and contact manifolds, the Delzant theorem, Morse theory, sheaves and Čech cohomology, and aspects of Calabi-Yau manifolds.

Marcel BERGER. — **A panoramic view of Riemannian geometry.** — Un vol. relié, 16×24, de XXIII, 824 p. — ISBN 3-540-65317-1. — Prix: €59.95.— Springer, Berlin, 2003.

Riemannian geometry has today become a vast and important subject. This new book of Marcel Berger sets out to introduce readers to most of the living topics of the field and convey them quickly to the main results known to date. These results are stated without detailed proofs but the main ideas involved are described and motivated. This enables the reader to obtain a sweeping panoramic view of almost the entirety of the field. However, since a Riemannian manifold is, even initially, a subtle object, appealing to highly non-natural concepts, the first three chapters devote themselves to introducing the various concepts and tools of Riemannian geometry in the most natural and motivating way, following in particular Gauss and Riemann.

Udo HERTRICH-JEROMIN. — **Introduction to Möbius differential geometry.** — London Mathematical Society lecture note series, vol. 300. — Un vol. broché, 15×23, de XI, 413 p. — ISBN 0-521-53569-7. — Prix: £29.95. — Cambridge University Press, Cambridge, 2003.

The book introduces the reader to the geometry of surfaces and submanifolds in the conformal n-sphere. Various models for Möbius geometry are presented: the classical projective model; the quaternionic approach; and an approach that uses the Clifford algebra of the space of homogeneous coordinates of the classical model — the use of 2+2 matrices in this context is elaborated. For each model, in turn, applications are discussed. Topics comprise conformally flat hypersurfaces, isothermic surfaces and their transformation theory, Willmore surfaces, orthogonal systems, and the Ribaucour transformation, as well as analogous discrete theories for isothermic surfaces and orthogonal systems. Certain relations with curved flats, a particular type of integrable system, are revealed.

Topologie algébrique

F.E.A. JOHNSON. — **Stable modules and the D(2)-problem.** — London Mathematical Society lecture note series, vol. 301 — Un vol. broché, 15×23, de IX, 267 p. — ISBN 0-521-53749-5. — Prix: £29.95. — Cambridge University Press, Cambridge, 2003.

This book is concerned with two fundamental problems in low-dimensional topology. Firstly the D(2)-problem, which asks whether cohomology detects dimension, and secondly the realization problem, which asks whether every algebraic 2-complex is geometrically realizable. The author shows that for a large class of fundamental groups these problems are equivalent. Moreover, in the case of finite groups, Professor Johnson develops general methods and gives complete solutions in a number of instances. In particular, he presents a complete treatment of Yoneda extension theory from the viewpoint of derived objects and proves that for groups of period four, two-dimensional homotopy types are parametrized by isomorphism classes of projective modules. The book is carefully written with an eye on the wider context and as such is suitable for graduate students wanting to learn low-dimensional homotopy theory as well as for established researchers in the field.

Elon Lages LIMA. — **Fundamental groups and covering spaces.** — Un vol. relié, 16×23,5, de VII, 210 p. — ISBN 1-56881-131-4. — Prix: US$49.00. — A. K. Peters, Natick, Massachusetts, 2003.

This is an introductory book on fundamental groups, perhaps the simplest non-trivial algebraic structure that one can attach to a space, and their topological soul mates, the covering spaces. An accomplished example of the algebraic topologist's dream come true, covering spaces are a geometric (that is, topological) structure that is completely characterized by its algebraic counterpart. Fundamental groups and covering spaces are interesting not only for their intrinsic elegance, but are also important auxiliary instruments in complex analysis, differential geometry, group theory, and physics. This book provides several illustrative examples from these areas. In keeping with its introductory aim, basic concepts are clearly defined, proofs are complete, and no results from the exercises are assumed in the text.