1 Book reviews

Handbook of Convex Geometry
P.M. Gruber and J.M. Wills (eds.)
Convex Sets and Related Geometric Topics
Geometry
Volume A,1993, 816 pages, Price: Dfl. 295.00 (US $ 168.50), ISBN 0-444-89596-5 Hardbound
Volume B, 1993, 780 pages, Price: Dfl. 285.00 (US $ 162.75), ISBN 0-444-89597-5 Hardbound
Two-Volume Set, Price: Dfl. 540.00 (US $ 308.50), ISBN 0-444-89598-1, North-Holland, Elsevier Science Publishers

Convex geometry became a mathematical discipline on its own around the turn of the century, mainly under the influence of the work of Hermann Minkowski. Around the mid thirties, one book (the famous 'Theorie der konvexen Körper' of Bonnesen and Fenchel) could contain almost all results, methods and proofs. During the last decades, the research in convex geometry has grown so much, that there is a strong need for a survey of convex geometry with all its ramifications. This is the main aim of this handbook, which consists of a collection of survey papers contributed by 38 prominent mathematicians active in the field.
The content of the handbook is divided in five parts. Because it would take us too long to review each contribution separately, only titles and authors are listed. It may already give a first impression on the variety of topics treated in the handbook.
0. History of convexity (*P.M. Gruber*).
Part 1, Classical Convexity.
1.1 Characterizations of convex sets (*P. Mani-Levitska*).
1.2 Mixed volumes (*J.R. Sangwine-Yager*).
1.3 The standard isoperimetric theorem (*G. Talenti*).
1.4 Stability of geometric inequalities (*H. Groemer*).
1.5 Selected affine isoperimetric inequalities (*E. Lutwak*).
1.6 Extremum problems for convex discs and polyhedra (*A. Florian*).
1.7 Rigidity (*R. Connelly*).
1.8 Convex surfaces, curvature and surface area measures (*R. Schneider*).
1.9 The space of convex bodies (*P.M. Gruber*).
1.10 Aspects of approximation of convex bodies (*P.M. Gruber*).
1.11 Special convex bodies (*E. Heil, H. Martini*).

Part 2, Combinatorial Aspects of Convexity.
2.1 Helly, Radon, and Carathédory type theorems (*J. Eckhoff*).
2.2 Problems in discrete and combinatorial geometry (*P. Schmitt*).
2.3 Combinatorial aspects of convex polytopes (*M.M. Bayer, C.W. Lee*).
2.4 Polyhedral manifolds (*U. Brehm, J.M. Wills*).
2.5 Oriented matroids (*J. Bokowski*).
2.6 Algebraic geometry and convexity (*G. Ewald*).
2.7 Mathematical programming and convex geometry (*P. Gritzmann, V. Klee*).
2.8 Convexity and discrete optimization (*R.E. Burkard*).
2.9 Geometric algorithms (*H. Edelsbrunner*).

Part 3, Discrete Aspects of Convexity.
3.1 Geometry of numbers (*P.M. Gruber*).
3.2 Lattice points (*P. Gritzmann, J.M. Wills*).
3.3 Packing and covering with convex sets (*G. Fejes Tóth, W. Kuperberg*).
3.4 Finite packing and covering (*P. Gritzmann, J.M. Wills*).
3.5 Tilings (*E. Schulte*).
3.6 Valuations and dissections (*P. McMullen*).
3.7 Geometric crystallography (*P. Engel*).

Part 4, Analytic Aspects of Convexity.
4.1 Convexity and differential geometry (*K. Leichtweiss*).
4.2 Convex functions (*A.W. Roberts*).
4.3 Convexity and calculus of variations (*U. Brechtken-Manderscheid, E. Heil*).
4.4 On isoperimetric theorems of mathematical physics (*G. Talenti*).
4.5 The local theory of normed spaces and its applications to convexity (*J. Lindenstrauss, V. Milman*).
4.6 Nonexpansive maps and fixed points (*P.L. Papini*).
4.7 Critical exponents (*V. Pták*).
4.8 Fourier series and spherical harmonics in convexity (*H. Groemer*).
4.9 Zonoids and generalisations (*P. Goodey, W.

Weil).
4.10 Baire categories in convexity (*P.M. Gruber*).

Part 5, Stochastic Aspects of Convexity.
5.1 Integral geometry (*R. Schneider, J.A. Wieacker*).
5.2 Stochastic geometry (*W. Weil, J.A. Wieacker*).

The first two parts are treated in the first volume, the second volume starts with the third part. Other subdivisions are possible; one can find papers concerned with computational aspects of convexity in different parts.
As the book is intended as a survey, many efforts have been made to make the material easily accessible to novice readers. Many authors start from scratch, by defining even convexity again. References to the specialized literature can be found at the end of each survey paper and are not smashed all together. Hereby all reference papers are mentioned at least once and are put into their proper perspective. The Author Index at the end of each volume allows the reader to trace back the papers of each author to the place where they are cited. Both volumes can be considered apart from each other. They start both with the same Preface and have both the same full Author and Subject Index. The Author Index consists of 34 pages, with about 50 entries per page. Authors and all author combinations are listed alphabetically. The Subject Index consists of 20 pages, with more than 80 entries per page.
In the preface, the editors warn already that not all possible aspects of convexity could be covered. This can be illustrated by the fact that the notion of a 'fan' does not appear in the Subject Index. Though fans are one of the geometrical key concepts briefly mentioned in chapter 2.1 on 'Algebraic geometry and convexity'. They certainly deserved a more general treatment, as they reflect the essential combinatorics of polytopes. However, fans seem to originate from the theory of toric varieties and have not (yet) been studied on their own (until very recently). Another point of criticism is that only few survey papers refer to other papers in the handbook; the reader is left somewhat alone in her/his search for the connections between the concepts presented in various chapters.
The handbook is intended for three groups of readers. Students and other readers novice to the domain can find in this overview starting points to investigate particular topics. Specialists in the field can use the book as reference work. Researchers who want to apply results of convex geometry can look up various geometrical concepts, results and algorithms.
This handbook represents the state of the art in this rapidly growing and very attractive research field. The editors have realized a major achievement in bringing all these prominent researchers together to work on this project. Both volumes of the handbook have been very inspiring to me and provided me a general and broad view on convex geometry. I would like to recommend it to anyone concerned with any aspect of convexity.

J. Verschelde

Polynomial and Matrix Computations. Volume 1: Fundamental Algorithms
Dario Bini and Victor Pan
Progress in Theoretical Computer Science, Birkhäuser, 1994, xvi + 415 pages

This work discusses the design of algorithms for matrix and polynomial computation. More especially, univariate polynomials and dense structured matrices such as Toeplitz and Hankel matrices whose relation with polynomials is well known. In this respect, it can be considered as a successor of the classic by A.V. Aho, J.E. Hopcroft and J.D. Ullman: *The design and analysis of computer algorithms*, Addison-Wesley, 1976.
The book is successful in narrowing the gaps between numerical and symbolic computation and between matrix and polynomial algorithms. To the existing classics in this field, it adds the discussion of recent developments and of parallel computation. However, by touching upon so many topics, which require so many different backgrounds that many readers may not have, one is practically forced to read the book from cover to cover. By a persistent integration of the different approaches and subjects, one section of the book will not only treat a specific topic, but it will be related to many other topics and sections