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Book reviews

Pitici, M. (Ed.): *The best writing on mathematics*—2012. XXIX, 288 pp., Princeton University Press, Princeton, New Jersey, 2013. GBP 13,95.

Dieser, einem großen interessierten Leserkreis empfehlenswerte Band, behandelt in 24 Aufsätzen (u.a. von Fieldsmedaillengewinnern) interessante, historische, philosophische, didaktische Themen über Wesen, Bedeutung und Praxis der Mathematik. Wertvoll ist auch, dass hier persönliche Erfahrungen der Autoren wesentlich miteinfliessen und nebenbei auch ein Bild der großen Vielfalt mathematischer Persönlichkeiten und Einstellungen mitvermittelt wird. Angesichts der Fülle des Gebotenen, mit vielen faszinierenden und für nicht wenige Leser auch überraschenden Einsichten, ist hier eine adäquate detaillierte Würdigung nicht möglich, aber durch folgende Inhaltsübersicht gut andeutbar.

D. Mumford, Vorwort: The Synergy of Pure and Applied Mathematics, of the Abstract and Concrete, M. Pitici: Einleitung, M. Livio: Why Math Works, T. Gowers: Is Mathematics Discovered or Invented ?, P. Rowlett: The Unplanned Impact of Mathematics, B. Hayes: An Adventure in the Nth Dimension, T. Tao: Structure of Randomness in Prime Numbers, J. C. Baez and J. Huerta: The strangest Numbers in String Theory, D. Swart and B. Torrence: Mathematics Meets Photography: The Viewable Sphere, S.-M. Belcastro and K. Schaffer: Dancing Mathematics and the Mathematics of Dance, R. Schneiderman: Can One Hear the Sound of a Theorem ?, R. J. Lang: Flat Unfoldability and Woven Origami Tessellations, T. Gowers: A Continuous Path from High School Calculus to University Analysis, B. Davis: Mathematics Teachers' Subtle, Complex Disciplinary Knowledge, E. Flapan: How to be a good Teacher Is an Undecidable Problem, B. Gold: How Your Philosophy of Mathematics Impacts Your Teaching, S. S .Epp: Variables in Mathematics Education, J. Gray: History of Mathematics and Science Reunited ?, Ch. Simmons: Augustus de Morgan behind the Scenes, G. Bruno, A. Genovese and G. Impromta: Routing Problems: A History of Perspective, G. L. Alexanderson: The Cycloid and Jean Bernoulli, F. Q. Gouvéa: Was Cantor Surprised ?, J. Hacking: Why is There Philosophy of Mathematics at All ?,

R. Elwes: Ultimatic Logic: To Infinity and Beyond, M. Colyvan: Mating, Dating, and Mathematics: It's All in the Game.

H. Rindler, Wien

Heldermann, N.: *Höhere Mathematik 2* (Berliner Studienreihe zur Mathematik Band 23). VI, 294 pp., Heldermann, Lemgo, 2014. EUR 32,00.

Der zweite Band der "Höheren Mathematik" behandelt folgende Themen: Kap. 8: Die komplexen Zahlen (mit einem elementaren Beweis des Fundamentalsatzes der Algebra); Kap. 9: Unbestimmte Integration (einschliesslich Partialbruchzerlegung ohne Beweis—der Hinweis auf 8.4.14 wäre hilfreich); Kap. 10: Differentialgleichungen (linear 1. Ordnung, linear 2. Ordnung mit konstanten Koeffizienten); Kap. 11: Bestimmte Integration (mit Berechnung von Volumina und Schwerpunkten, numerische Integration); Kap. 12: Parametrische Kurven (mit Steigung, Bogenlänge, Krümmung, Sektorenflächen); Kap. 13: Vektoren und Matrizen (vielfach ohne Beweis); Kap. 14: Lineare Optimierung (in n Variablen); Kap. 15: Spieltheorie (Bimatrixspiele, Nullsummenspiele). Damit werden in den beiden Bänden (zusammen mit der entsprechenden Aufgabensammlung) die wichtigsten Gebiete der Mathematik behandelt, die beim Übergang von der Schule zur Hochschule in den ersten Semestern von Studien von Bedeutung sind, die mathematisches Grundwissen benötigen (Statistik und Wahrscheinlichkeitstheorie wurden nicht aufgenommen). Die Darstellung ist leicht verständlich und anschaulich, der Stoff durch viele Beispiele aus Anwendungen motiviert und durch ausführliche Berechnungen erklärt.

H. Mitsch, Wien

Rauch, J.: *Hyperbolic Partial Differential Equations and Geometric Optics.* (Graduate Studies in Mathematics Volume 133). XIX, 363 pp., American Mathematical Society, Providence, Rhode Island, 2012. USD 64,00.

This is an up to date introduction to hyperbolic partial differential equations with a focus on linear and nonlinear geometric optics. The first five chapters cover linear problems (linear Cauchy problems, dispersive behavior, linear elliptic and linear hyperbolic geometric optics). The author then turns to the nonlinear Cauchy problem (Chapter 6), before treating one phase nonlinear geometric optics in Chapters 7 and 8. The remaining Chapters 9–11 are devoted to resonance phenomena, as well as dense oscillations for the compressible Euler equations. A noteworthy omission is the theory of pseudodifferential operators, which the author avoids in order not to lose too much time for developing machinery. Also, he feels that the expansions of geometric optics provide a natural substitute. The book is addressed to graduate students who 'have studied one hard course in partial differential equations', and offers a hands-on-approach with many exercises interspersed in the text. It is a valuable addition to the literature on hyperbolic equations by one of the leading experts in the field.

M. Kunzinger, Wien

Zworski, M.: *Semiclassical Analysis.* (Graduate Studies in Mathematics Volume 138). XII, 431 pp., American Mathematical Society, Providence, Rhode Island, 2012. USD 75,00.

This text provides a systematic introduction and reference text for methods of semiclassical analysis, a field that originates from the transition between classical and quantum physics as the Planck constant goes to zero. Standard tools in the field are WKB methods or geometric optics. Mathematically, it can be viewed as a sub-field of microlocal analysis. This volume is divided into 5 parts: Part 1, Basic Theory, contains introductions to symplectic geometry, Fourier transforms, and semiclassical quantization. Part 2 gives applications to PDEs (semiclassical defect measures, eigenvalues and eigenfunctions, and estimates for solutions of PDE). In Part 3, advanced theory and applications are discussed (symbol calculus, Fourier Integral Operators, normal forms, and FBI transform, among others). Part 4 deals with semiclassical analysis on manifolds, while Part 5 contains various appendices on basic notions from differential forms, functional analysis and Fredholm theory. The book is carefully written and is very likely to become a standard reference in the field.

M. Kunzinger, Wien

Krieger, J., Schlag, W.: *Concentration Compactness for Critical Wave Maps.* (EMS Monographs in Mathematics). VI, 484 pp., European Mathematical Society, Zürich, 2012. EUR 88,00.

This work provides a fundamental contribution of the authors to the large data wave map problem with target manifold the hyperbolic plane. The guiding idea is to apply (and extend) the concentration compactness method of Bahouri and Gerard, and Kenig and Merle. Compared with previous, more qualitative approaches to this problem, a major improvement lies in the fact that quantitative bounds on the wave map and its derivatives are achieved.

M. Kunzinger, Wien

Bhattacharyya, P. K.: *Distributions*—Generalized functions with applications in Sobolev spaces. (De Gruyter Textbook). XXXVIII, 833 pp., De Gruyter, Berlin, Boston, 2012. EUR 69,95.

The purpose of this monumental work is to make distribution theory accessible to the applied community, while giving detailed and complete arguments for all basic results. In more than 800 pages, the author treats all the main topics of distribution theory (basic operations, differentiation, local properties, convolution, Fourier transform, vector valued distributions), while also laying particular emphasis on the theory of Sobolev spaces. The book can be read with minimal prerequisites and contains a wealth of illustrative examples and applications. It also provides appendices on fundamentals from Functional Analysis, Lebesgue Spaces and Boundary Geometry.

Moreover, it can serve as reference work for many aspects of the theory of generalized functions.

M. KUNZINGER, WIEN

Greenbaum, A., Chartier, T. P.: *Numerical Methods*—Design, Analysis and Computer Implementation of Algorithms. XIV, 454 pp., Princeton University Press, Princeton and Oxford, 2012. GBP 65,00.

Numerical methods cover a huge range of diverse topics, both from the mathematical standpoint and from the standpoint of applications. In fact, the growth of fields of applications is impressive and vital to the areas. Also impressive is the change in solution strategies. It is therefore tempting not to produce a voluminous book in the proof-theorem style but to actually present both strands, methods and possible applications. This is what the present book is about, and in addition it provides an introduction to MATLAB and a link to pertinent programs. Basically, the book touches upon every topic one reasonably can expect in this context. There are some general chapters dispersed throughout the book (on the modeling process, the use of MATLAB, on floating point arithmetic and the stability of numerical processes). The body of the book covers all of what must be considered standard material. We find chapters on the solution of nonlinear equations in one unknown, direct and iterative methods of numerical linear algebra, numerical integration, initial and boundary value problems for ordinary differential equations and on partial differential equations. In order to just give a feeling of the covering of material, the chapter on initial value problems for ordinary differential equations deals with one- and multistep methods, discusses questions of convergence and of stability regions of the methods. It also tackles how to deal with stiff equations, how to solve the systems of equations arising when using implicit methods and illustrates accuracy and properties of the procedures by a number of examples. Such examples and exercises serve also to introduce the student to phenomena which are accessible in such a way. For this and to the other chapters supplementary material (MATLAB codes) is provided. The book is well written and rendered more lively by the inclusion of short notes on various researchers which have contributed to the development of the methods.

H. MUTHSAM, WIEN