Book Reviews

Wong, M. W.: *An Introduction to Pseudo-Differential Operators* 3rd Edition (Series on Analysis, Applications and Computation—Vol. 6). X, 184 pp., World Scientific Publishing, New Jersey London Singapore Beijing Shanghai Hong Kong Taipei Chennai, 2014. £25,00.

This is the third edition of the introductory textbook on pseudo-differential operators, which has originally appeared in 1991. While this edition features substantial additions as compared with the previous editions it still maintains the main characteristics of its predecessors. It is a careful introductory text which only assumes minimal prerequisites and gently leads the beginning graduate student into (mainly) the global theory of elliptic pseudo-differential operators on L^p-spaces. The new chapters deal with the use of the Gårding inequality in proving existence and uniqueness results as well as more functional analytic aspects such as Fredholm-properties, index formulas, and spectral invariance. These additions are very welcome and further enhance the already very high usefulness and quality of the previous editions.

R. STEINBAUER, WIEN

Assani, I. (ed.): *Ergodic Theory and Dynamical Systems* Proceedings of the Ergodic Theory Workshops at University of North Carolina at Chapel Hill, 2011–2012 (Proceedings in Mathematics). X, 276 pp., De Gruyter, Berlin Boston, 2014. EUR 99,95.

Das Buch enthält zwölf Beiträge aus Workshops in denen neuere Entwicklungen der Ergodentheorie behandelt wurden. Dabei gibt es auch Querverbindungen zu Zahlentheorie, harmonischer Analyse und Algebra.

V. LOSERT, WIEN

Dumas, H. S.: *The KAM Story* A Friendly Introduction to the Content, History, and Significance of Classical Kolmogorov–Arnold–Moser Theory. XV, 361 pp., World

$\underline{\textcircled{2}}$ Springer

Scientific, New Jersey London Singapore Beijing Shanghai Hong Kong Taipei Chennai, 2014. £50,00.

In 1954 Andrey Kolmogorov realised a fundamental fact about dynamical systems: quasiperiodic motions are persistent under small perturbations. Rigorous proofs were given in the early 1960s by Jürgen Moser (for smooth twist maps) and by Vladimir Arnold (for analytic Hamiltonian systems). The resulting KAM-theory has to be seen as one of the milestones in the mathematical physics of the 20th century. This book tells its story in a broad context. While it does not delve too much into mathematical detail it provides an informed and informative historical overview. Indeed after setting up the minimal mathematical background (chapter 2) it tells the pre-KAM story, i.e., the paradox discovered by Henri Poincaré in the context of the Newtonian three body problem: most classical mechanical systems should be chaotic, while such a behaviour was not observed experimentally. Its resolution, the main body of KAM-theory is presented in chapters 4 and 5 with some further results in Hamiltonian perturbation theory deferred to chapter 6. The final chapter 7 on applications in physics is followed by a series of very valuable and extensive appendices, in particular, a 25-page guide to further reading and a massive glossary of some 70 pages.

R. STEINBAUER, WIEN

Iosevich, A., Liflyand, E.: *Decay of the Fourier Transform* Analytic and Geometric Aspects. XII, 222 pp., Springer, Basel Heidelberg New York Dordrecht London, 2014. EUR 105,00.

It is a fundamental and far-reaching fact in mathematical analysis that the regularity of a function is reflected in the decay properties of its Fourier transform. The book under review is a guide to current developments in Fourier analysis—with an emphasis on recent work of the authors—analysing the interrelation of the analytic properties of a function and the geometric properties of its support on the one hand and the rate of decay of its Fourier transform on the other hand. The first part of the book (chapters 2–4) emphasises the analytic aspects and mainly deals with decay statements of averages over spheres. The second part (chapters 5–8) then deals more with the geometric aspects and decay estimates of the Fourier transforms of indicator functions of convex sets. The overall presentation is clear and the reader is carefully guided through this territory which is marked by a beautiful blend of ideas and techniques from analysis, geometry and also number theory.

R. STEINBAUER, WIEN

Muscat, J.: *Functional Analysis* An Introduction to Metric Spaces, Hilbert Spaces and Banach Algebras. XI, 420 pp., Springer, Cham Heidelberg New York Dordrecht London, 2014. EUR 50,00.

Eine Einführung in die Funktionalanalysis. Zu Beginn ein Abschnitt zur Topologie metrischer Räume. Dann findet man die Standardresultate über Hilbert- und Banachräume. Weiters ein wenig zu Banach- und C*-Algebren (auch im Hinblick auf

die Spektraltheorie). Auch Anwendungen (etwa inverse Probleme) werden erwähnt. Am Ende gibt es Hinweise zu weiterführender Literatur.

V. LOSERT, WIEN

Pérez Lopéz, C.: *MATLAB Numerical Calculations* Hands-on MATLAB Training and Exercises (Apress MATLAB Solutions Series). XV, 316 pp., Springer Apress, New York, 2014. EUR 49,50.

This book belongs to a series of twelve MATLAB books of the same author published in the same year and is the only one I have read. The positive aspect of the book is that it has taught me some new things and that it contains many exercises with solutions.

However, the shortcomings of the book are predominant. I did not manage to find any reference to the MATLAB version the author is using. Some commands did not work with my MATLAB version from 2014 (the year of publication of the book) or produced different results. I found the years 1999 and 2001 concealed in graphics and in answers to the exercises! The book does not contain an index of MATLAB commands and is not very well organized; for example, some topics (like loops and the distinction between functions and m-files) are dealt with in the chapter on functions and in the chapter on programming and numerical analysis. I doubt that it is suitable as an introduction for a person new to MATLAB. Moreover, a large part of the book is devoted to symbolic computations, particularly to the Extended Symbolic Math Toolbox (not available at my department), which allows to use Maple with the command 'maple'. A reader of a book with that title expects to learn about numerical calculations in pure MATLAB but only the last two chapters (on programming and numerical algorithms) do without the 'maple' command.

W. HUYER, WIEN

Harris, M.: *Mathematics without apologies* Portrait of a problematic vocation. XXII, 438 pp., Princeton Univ. Press, Princeton New Jersey, 2015. £20,00.

Großer Dank an den Autor, der als bedeutender Mathematiker sehr viel Zeit, Engagement, Leidenschaft aber auch Realismus und wichtige nicht-mathematische Kompetenzen investiert hat, um hier die vielschichtige Wunderwelt der Mathematik einem größeren Leserkreis zu eröffnen, wobei ein vielfältiges, breites und heterogenes Spektrum von Mathematikern, aber auch Aussenstehenden durchaus auch kritisch und kontroversiell zu Wort kommt. Dieses Buch, Gewinner des 2016 PROSE Award in Mathematics der Association of American Publishers, bereichert jede wissenschaftliche Bibliothek. Auch mathematisch wenig Kundige können hier wertvolle Anregungen gewinnen, u.a. wie weit Begriffe wie Kunst, Schönheit, Harmonie, Symmetrie, Wahrheit, Erkenntnisgewinn, Grundlagenproblematik, Nützlichkeit, Spiel, Prestige, Exzentrizität, Erfindung–Entdeckung u.v.a. eine Rolle spielen, oder auch die von Hardy in seinem Buch "A Mathematician's Apology" thematisierten Prinzipien unexpectedness, inevitability und economy. Hardys Purismus beruhte ja u.a. auch darin, dass für ihn übertriebenes Nützlichkeitsdenken für eine zunehmende Ungleichverteilung des Wohlstands mitverantwortlich war. Ihn hätten ja die erfolgreichen Anwendungen z.B. der Zahlentheorie in der Kryptologie oder seiner funktionalanalytischen Ergebnisse für die Black-Scholes Gleichung nicht erfreut. Die Vielfalt des hier Gebotenen (einige Kapitel sind erweiterte Versionen von früher Publiziertem

oder Präsentiertem) kann hier nicht einmal ansatzweise repräsentativ angedeutet werden. Einige (durchaus etwas willkürlich und subjektiv ausgewählte) Beispiele: Es finden sich viele Aussagen von Philosophen seit der Antike über die Mathematik. Bemerkenswert ist z.B., dass Plutarch erwähnt, dass Archimedes erklärt jede Kunst (Mathematik und Mechanik waren für ihn Künste; die Trennung zwischen Sciences und Arts wurde ja erst in der Aufklärung signifikant), falls reduziert zu einem "Diener der Nöte des Lebens", unedel und vulgär würde. Für Deligne war es eine besondere Freude, als Student zu erkennen, dass man als Mathematiker "spielerisch" seinen Lebensunterhalt verdienen könne. Für viele passionierte Mathematiker ist damit aber eine sehr arbeitsintensive Einstellung verbunden. Zitiert sei auch die Aussage von Manin "Why should we put ourselves on the market? We (a) don't cost anything, and (b) don't use up natural ressources and don't spoil the environment. Give us salaries, and leave us in peace", oder die generöse Geste von Koblitz, dem Miterfinder der Anwendung elliptischer Kurven in der Kryptografie, was ja zu einem Billionengeschäft geführt hat, der sein dafür erhaltenes monatliches Konsulenten-Gehalt von 1.000 Dollar weggab, da ihm die Arbeit ja fast ausschließlich Freude bereitet hatte; ganz zu schweigen von Perelman, der weder die Fields-Medaille noch den Millenium-Preis von 1 Million Dollar annahm. Die stark zunehmende Bedeutung mathematischer Methoden für Anwendungen in vielen Disziplinen ist aber sowohl für die Gesellschaft als auch für die Weiterentwicklung der Mathematik höchst wertvoll. Für Cantor war auch ein Freiheitsbegriff in der Mathematik sehr wichtig, wie auch für Hausdorff (auch in anderer Hinsicht durch seinen Freitod angesichts des zu erwartenden Abtransports nach Theresienstadt durch die Nazis), der im Nachwort"The Veil of Maya" speziell gewürdigt wurde. Für ihn, der ja auch unter dem Pseudonym P. Mongré schriftstellerisch tätig war, waren Spielräume des Denkens, der Anschauung und Erfahrung wesentlich. Instruktiv für ein breiteres Publikum sind mehrere Abschnitte mit dem Thema "How to Explain Number Theory at a Dinner Party". Aussagekräftig sind die Kapitelüberschriften: (1) Introduction: The Veil, (2) How I Acquired Charisma, (3) Not Merely Good, True, and Beautiful, (4) Megaloprepeia, ("Großartigkeit im Tun des Geziemenden") (5) An Automorphic Reading of Thomas Pynchon's Against the Day (Interrupted by Elliptical Reflections on Mason and Dixon), (6) Further Investigations of the Mind–Body Problem, (7) The Habit of Clinging to an Ultimate Ground, (8) The Science of Tricks (dabei ist"Trick" ins Deutsche nicht mit "Trick" zu übersetzen, sondern etwa durch "Kunstgriff"; eine ähnlich adäquate Übersetzung ins Chinesische gibt es nicht !), (9) Mathematical Dream and Its Interpretation, (10) No Apologies. Besonders wertvoll sind zahlreiche am Ende dieses Werks gesammelte Fußnoten.

<div align="right">H. RINDLER, WIEN</div>

Iwaniec, H.: *Lectures on the Riemann Zeta Function.* (University Lecture Series Vol. 62). VII, 119 pp., American Mathematical Society, Providence, Rhode Island, 2014. USD 40,00.

This slim monograph is based on a course taught by the author at Rutgers University in 2012. It aims to give a modern presentation of a well-known result by N. Levinson which says that asymptotically at least a third of the zeros of the Riemann zeta function in the critical strip are on the critical line. The book's first part starts out with basic results such as the Euler–Maclaurin summation formula, Tchebyshev's

estimates, and the analytical continuation and the functional equation of the Riemann zeta function. It ends with a classical result by Hardy and Littlewood which says that $N_0(T) \gg T$ (where $N_0(T)$ denotes the number of zeros s with $\mathrm{Re}(s) = 1/2$ and $0 < \mathrm{Im}(s) \leq T$). The second part is devoted to the proof of Levinson's result and includes subsequent improvements and additions by J. B. Conrey and the author. The presentation is demanding and might be a challenge for newcomers to the field. This volume is an important addition to the literature on the distribution of the zeros of the Riemann zeta function.

<div align="right">Ch. Baxa, Wien</div>

Lie, S.: *Theory of Transformation Groups I.* General Properties of Continuous Transformation Groups. A Contemporary Approach and Translation. XV, 643 pp., Springer, Heidelberg New York Dordrecht, 2015. EUR 121,00.

This is a new translation by J. Merker of Sophus Lie's classic on the theory of transformation groups. The original, for which F. Engel is listed as a "collaborator", was published in 1888 in German. The translator considers the first four chapters of the book, in which Lie sets up the beginnings of the theory in the largest possible generality, as basically untranslatable. Therefore, he decided to write a modern presentation of the material covered in these first four chapters, which in particular proves the results needed in the later parts. This covers about 90 pages. The rest of the book contains a translation of the remaining 25 chapters of Lie's original work. A glossary of significantly used words and phrases and their translation and a short index are provided.

<div align="right">A. Cap, Wien</div>

Bourguignon, J.-P., Jeltsch, R., Pinto, A. A., Viana, M. (Eds.): *Dynamics, Games and Science* International Conference and Advanced School Planet Earth, DGS II, Portugal, August 28–September 6, 2013 (CIM Series in Mathematical Sciences 1). XVIII, 772 pp., Springer, Cham Heidelberg New York Dordrecht, 2015. EUR 182,00.

Dieser Band enthält Beiträge einer Konferenz in Lissabon 2013 "Advanced School Planet Earth, Dynamics, Games and Sciences" mit dem Ziel die zunehmend wichtigere Bedeutung der Mathematik in vielen Anwendungsbereichen auf vielfältige Weise zu unterstreichen. Die behandelten Themen betreffen mathematische Entwicklungen in Spieltheorie und dynamischen Systemen sowie interdisziplinäre Beiträge aus zahlreichen Gebieten wie Ökonomie, Populationsdynamik, Ökologie, Gesundheitsvorsorge, Zellbiologie und Physik. Die 39 Beiträge (eine heterogene Mischung von unterschiedlicher mathematischer Qualität und Anwendungsorientiertheit) speziell zu besprechen fehlt hier der Platz.

<div align="right">H. Rindler, Wien</div>

Bourguignon, J.-P., Hijazi, O., Milhorat, J.-L., Moroianu, A., Moroianu, S.: *A Spinorial Approach to Riemannian and Conformal Geometry.* Monographs in Mathematics. IX, 452 pp., European Mathematical Society Zürich, 2015. EUR 78,00.

Assuming a basic background in Riemannian geometry, this book offers a nice and comprehensive introduction to applications of spinors in Riemannian and conformal geometry. Starting from basic material on Clifford algebras, the first part of the book

<div align="right">🅐 Springer</div>

develops the theory of spin-and spin^c-structures and the associated Dirac operators, as well as the analytical background needed to study the spectrum of the Dirac operator and of the Laplacian. The second and third parts study the lowest eigenvalue of the Dirac operator, and special spinor fields and their relations to special geometric structures, respectively. For both topics, apart from general Riemannian and conformal manifolds, the cases of Kähler-and quaternion-Kähler manifolds are treated separately. The last part of the book uses representation theory to study the complete spectrum of the Dirac operator on some model spaces, in particular for several examples of symmetric spaces.

A. CAP, WIEN

Nagel, W. E., Kröner, D. H., Resch, M. M. (Eds): *High Performance Computing in Science and Engineering '14.* Transactions of the High Performance Computing Center, Stuttgart (HLRS) 2014. XIII, 691 pp., Springer, Cham Heidelberg New York, 2015. Euro 154,00.

A workshop has been held to gain an overview on research carried out at two large German computer centers (Stuttgart and Karlsruhe; September 2014). The aim of the meeting has been to promote large-scale computing projects. Attention has also been directed towards the development of highly scalable software. The areas covered concern a large range of scientific and engineering disciplines. The present report contains selected papers. These pertain to work performed in a specific 1-year period and focus on computational aspects as well as on scientific results. They cover a broad range of topics from particle physics to astrophysics and technical issues as well.

H. MUTHSAM, WIEN