MATCH
Communications in Mathematical and in Computer Chemistry

MATCH Commun. Math. Comput. Chem. **63** (2010) 819-820

ISSN 0340 - 6253

BOOK REVIEW

An Introduction to the Theory of Graph Spectra

by

Dragoš Cvetković, Peter Rowlinson and Slobodan Simić

Cambridge University Press, Cambridge, 2010, XI+364 pp. ISBN 978-0-521-11839-2 (Hardback), 978-0-521-13408-8 (Paperback)

Everybody who studied and did research in graph spectral theory had to use the seminal monograph "*Spectra of Graphs – Theory and Application*" by Cvetković, Doob and Sachs, published in 1980 and then again in 1982, 1984, and 1995. This book contains practically everything what in spectral graph theory was discovered and published until the middle of the 1970s. Because in the following 30 years an enormous amount of new material in this field has accumulated, it gradually became obvious that a new source book is needed. It also became obvious that it is no more possible to provide a survey of all existing results, and that in any new monograph only a selection of (most relevant) results on graph spectra could be included. The book "An Introduction to the Theory of Graph Spectra" is aimed at satisfying the needs of the great many students and young researchers, interested in spectral graph theory. Indeed, the book is published as "Student Text No. 75" of the London Mathematical Society.

The book consists of Preface, nine chapters (1. Introduction, 2. Graph Operations and Modifications, 3. Spectrum and Structure, 4. Characterization by Spectra, 5.

Structure and One Eigenvalue, 6. Spectral Techniques, 7. Laplacians, 8. Some Additional Results, 9. Applications), Appendix, References (with 503 bibliographic items quoted), Index of Symbols, and Index of Terms. At the end of each chapter (except chapter 9) there is a list of exercises. At the end of each chapter there is also a short "*Note*" in which the reader is directed to additional readings and where some results not elaborated in the book are mentioned and commented. In Chapter 9 the best known applications of graph spectra in physics, chemistry, computer science, and other fields of mathematics are briefly outlined. In the Appendix are given tables with spectra, characteristic polynomials, and other relevant spectral data for graphs with at most 5 vertices, connected graphs with 6 vertices, trees with at most 9 vertices, and cubic graphs with at most 12 vertices.

The list of over 500 references quoted in the book looks impressive. However, it is just a small fraction of papers that have been published until now. This reviewer estimates that their number is of order 10^4 , and that it increases with a speed greater than one per day.

Bearing this in mind, it is nowadays impossible to survey all existing results of graph spectral theory, and therefore the authors necessarily had to select those which they consider most relevant. Although it is noticeable that a slight preference is given to results obtained by Cvetković, Rowlinson, and Simić (of course!), there is no doubt that all major results – both old and new – can be found in this book. In other words, the book provides a complete and representative overview of the present state of art of this discipline of discrete mathematics.

Papers dealing with applications of graph spectra frequently and in large number appear in *MATCH Communications in Mathematical and in Computer Chemistry*. The readers and contributors of *MATCH Communications in Mathematical and in Computer Chemistry* will certainly need this book and find it both useful and stimulating. This reviewer suggests them to promptly get a copy of the "Introduction to the Theory of Graph Spectra". It is to be expected that this book will soon become a citation classic in Mathematical Chemistry and probably also in Discrete Mathematics.

Ivan Gutman