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Introduction to random matrices. Theory and practice. (English) Zbl 1386.15003

SpringerBriefs in Mathematical Physics 26. Cham: Springer (ISBN 978-3-319-70883-6/pbk; 978-3-319-70885-0/ebook). ix, 124 p. (2018).

In their preface, the authors state that ‘this is a book for absolute beginners’. Well, that depends on the definition of a beginner! Here, (s)he should be thoroughly at home in probability theory and statistical methods and prepared to do a lot more than dot the i’s and cross the t’s, because further along the preface, the authors ‘are sure ...that any seriously interested reader ...willing to dedicate some of their time to read and understand this book till the end, will next be able to... understand any other source ...on RMT, ...’. That’s a tough assignment in 124 pages: from the beginning the reader is plunged in at the deep end.

The book covers standard material – classical ensembles, orthogonal polynomial methods, spectral densities and spacings, and also some advanced topics – the replica approach and free probability. There are 17 chapters (listing the titles doesn’t reveal much) on topics like Wigner’s surmise, joint pdf of eigenvalues of Gaussian matrices, Dyson index, classification of matrix models, Wigner matrices, Wigner’s semicircle law for Gaussian matrices, the Coulomb gas technique, Wishart-Laguerre ensemble, Vandermonde determinant, resolvent, Sokhotski-Plemelj formula, inverse participation ratio, Porter-Thomas distribution, Dyson-Gaudin integration lemma, Andriief identity, Anti-Wishart ensemble, Marčenko-Pastur density, Edwards-Jones formula, the replica trick, and an overview of free probability theory.

The emphasis is on concepts, computations and tricks of the trade, and the style is modern and informal, which the reader will no doubt enjoy. There are many ‘question boxes’ for asides on the main text, and “To know more” sections at the end of most chapters. Moreover, every chapter ends with references relevant to that chapter, and many calculations are accompanied by references to their numerical verification in an online file provided by the authors. The book has, however, no index (but the reviewer’s copy has 3 empty pages at the end where the reader can start their own). This monograph should prove to become a very welcome companion to the serious and enthusiastic reader setting out to get to know this vast and very useful subject.

Reviewer: [Rabe von Randow \(Bonn\)](#)

MSC:

- 15-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to linear algebra
- 15B52 Random matrices (algebraic aspects)
- 60-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to probability theory
- 60K40 Other physical applications of random processes
- 00A69 General applied mathematics

Cited in 1 Review Cited in 3 Documents

Keywords:

[random matrices](#); [classical ensembles](#); [orthogonal polynomial techniques](#); [spectral densities](#); [replica approach](#); [free probability](#)

Software:

[Matlab](#)

Full Text: [DOI](#)