PREFACE

Random matrices first appeared in multivariate statistics with the work of Wishart, Hsu and others in the 1930s and enjoyed tremendous impetus in the 1950s and 1960s due to the important contribution of Dyson, Gaudin, Mehta and Wigner.

The 1990s and beyond saw a resurgent random matrix theory because of the rapid development in low-dimensional string theory.

The next high-water mark involves the discovery of probability laws of the extreme eigenvalues of certain families of large random matrices made by Tracy and Widom. These turned out to be particular solutions of Painlevé equations building on the work of Jimbo, Miwa, Mori, Sato, Mehta, Korepin, Its and others.

The current volume in the IMS series resulting from a workshop held at the Institute for Mathematical Science of the National University of Singapore in 2006 has five extensive lectures on various aspect of random matrix theory and its applications to statistics and wireless communications.

Chapter 1 by Jack Silverstein studies the eigenvalue, in particular, the eigenvalue density of a general class of random matrices — only mild conditions were imposed on the entries — using the Stieltjes transform. This is followed by Chapter 2 of Peter Forrester which deals with those class random matrices where there is an explicit joint probability density of the eigenvalues and the "symmetry" parameter β which describe the logarithmic repulsion between the eigenvalues takes on general values. Chapter 3 by Zhidong Bai is a survey of the future in statistics taking into account of the impact modern high speed computing facilities and storage space. In the next two chapters, one finds applications of random matrix theory to wireless communications typified in the multi-input multi-output situation commonly found, for example, in mobile phones. Chapter 4 by Antonia Tulino uses the Shannon transform — intimately related to the Stieltjes

transform discussed in Chapter 1 — to compute quantities of interest in wireless communication. In the last chapter, Ralf Muller made use of the Replica Methods developed by Edwards and Anderson in their investigation of spin-glasses to tackle multiuser problems in wireless communications.

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