This interesting paper is devoted to the generalization of the Ginibre ensemble of non-Hermitian random square matrices. In 1965 Ginibre introduced a threefold family of non-Hermitian Gaussian random matrix ensembles as an extension to the theory of Hermitian random matrices. These ensembles have numerous applications in various fields of physics. They describe for instance, non-unitary dynamics of open quantum systems. Real non-symmetric random matrices can be used in mathematical finances to describe correlations between time series of prices of various stocks. Another application is in physiology to characterize correlations between data representing the electric activity of the human brain.

In the present paper the authors consider a generalization of the Ginibre ensemble of $N \times N$ matrices, specified by the probability distribution with density written in the form

$$p^{(\beta)}_{\text{IndG}}(G) = C^{(\beta)}_L (\det G^\dagger G)^{\beta L/2} e^{-((\beta/2) \text{Tr} G^\dagger G)},$$

where $C^{(\beta)}_L$ is a normalization constant, $L \geq 0$ is a free parameter. If the matrix is complex then $\beta = 2$, and in the case that $f$ is a real matrix then $\beta = 1$. The corresponding probability measure is induced by the ensemble of rectangular Gaussian matrices via a quadratization procedure. The authors derive the joint probability density of eigenvalues for such an induced Ginibre ensemble. They study various spectral correlation functions for complex and real matrices. It turns out that in the case of large dimensions the eigenvalues of the induced Ginibre ensemble cover uniformly a ring in the complex plane. The real induced Ginibre ensemble is shown to be useful to describe some statistical properties of evolution operators. In other words it is demonstrated that the stated ensemble can be linked to the evolution operators associated with generic complementary quantum operations.

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MSC:
81P15 Quantum measurement theory, state operations, state preparations
15B52 Random matrices (algebraic aspects)
81S22 Open systems, reduced dynamics, master equations, decoherence
91G60 Numerical methods (including Monte Carlo methods)
91B84 Economic time series analysis
92C55 Biomedical imaging and signal processing

Keywords:
Ginibre ensemble; random matrices; spectral correlation function; quantum operations; Feinberg-Zee ensemble

Full Text: DOI arXiv