Eigenvector statistics in non-Hermitian random matrix ensembles

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Abstract

We study statistical properties of the eigenvectors of non-Hermitian random matrices, concentrating on Ginibre's complex Gaussian ensemble, in which the real and imaginary parts of each element of an $N \times N$ matrix, J, are independent random variables. Calculating ensemble averages based on the quantity $\langle L_\alpha | L_\beta \rangle \langle R_\beta | R_\alpha \rangle$, where $\langle L_\alpha |$ and $| R_\beta \rangle$ are left and right eigenvectors of J, we show for large N that eigenvectors associated with a pair of eigenvalues are highly correlated if the two eigenvalues lie close in the complex plane. We examine consequences of these correlations that are likely to be important in physical applications.