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Systematics of spectral shifts in random matrix ensembles

Consider a reference matrix – an $N \times N$ matrix, randomly picked form one of the random Gaussian matrix ensembles ($\beta = 1, 2, 4$). Perturbing it with a sequence of rank-t matrices, with t taking the values between 1 and N, we study the expected difference between the spectra of the perturbed and the reference matrices as a function of t, as well as its dependence on the random matrix ensemble and the kind of rank-t perturbations. In particular, we consider a "mild" perturbation, which either permutes or randomises t *diagonal* elements. We derive universal expressions in the scaled parameter $\tau = t/N$ for the expectation of the variance of the spectral shift functions and show that it is proportional to $\sqrt{\tau}$ (*i.e.* sub-diffusive) in the limit of large N and t with a fixed ratio τ, as long as $\tau < \tau_{\max}(\beta)$.