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Markov operators, classical orthogonal polynomial ensembles, and random matrices

Abstract: Joint laws of the eigenvalues of unitary invariant ensembles of random matrices, as well as largest particle distributions of some random growth models, admit a determinantal structure which may be analyzed by kernels of orthogonal polynomials. For classical orthogonal polynomials, simple Markov operator tools allow for an efficient analysis of the spectral measures, emphasizing in particular the universal role of the arcsine distribution. They also lead to moment recursion equations such as the Harer-Zagier formula in case of the Gaussian Unitary Ensemble describing map enumeration problems. In addition, sharp bounds on the largest eigenvalue or largest particle of the random matrix or random growth models at the rate of the limiting Tracy-Widom distribution may be deduced from these tools. Orthogonal invariant ensembles may be analyzed similarly.