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Reduction of planar orthogonality to non-hermitian orthogonality on contours

The asymptotic behaviour of orthogonal polynomials associated with measures supported in the whole complex plane is of essential importance in obtaining various limiting spectral statistics for certain non-hermitian random matrix models. The standard tools to analyse the asymptotics for orthogonal polynomials on the real line or on a complex contour, including the celebrated Riemann-Hilbert method, are not readily avaliable in the planar setting.

For certain special measures, however, the two-dimensional hermitian orthogonality relations can be shown to be equivalent to a set of non-hermitian orthogonality relations with respect to an analytic weight function integrated on a combination of contours in the complex plane. This reduction amounts to solving a family of d-bar problems and, in certain cases, it simplifies the asymptotic analysis considerably since it allows the the Riemann-Hilbert approach to obtain strong asymptotics for the corresponding orthogonal polynomials. The method will be illustrated on an example based on a joint work with M. Bertola, S.Y. Lee and K. McLaughlin.