

Random matrices, continuous circular systems and the triangular operator

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Abstract

We present a Hilbert space approach based on direct integrals to the limit joint $*$ -distributions of complex independent Gaussian random matrices with non-identical variances. For that purpose, we use a suitably defined family of creation and annihilation operators decomposed in terms of continuous circular systems of operators acting between the fibers of the considered direct integral of Hilbert spaces. In the case of square matrices with i.i.d. entries, we obtain the circular operators of Voiculescu, whereas in the case of upper-triangular matrices with i.i.d. entries, we obtain the triangular operators of Dykema and Haagerup. We apply this approach to give a bijective proof of a formula for $*$ -moments of the triangular operator, using the enumeration formula of Chauve, Dulucq and Rechnitzer for alternating ordered rooted trees.