

Limit theorems for moment processes of beta Dyson's Brownian motions and beta Laguerre processes

Hoang Dung Trinh¹

¹ VNU University of Science, Hanoi
thdung.hus@gmail.com

Abstract:

Real beta ensembles are ensembles of real particles distributed according to the following joint probability density function

$$Z \cdot \prod_{i < j} |\lambda_j - \lambda_i|^\beta \prod_{l=1}^N w(\lambda_l), \quad (\beta > 0), \quad (1)$$

where $w(\lambda) \geq 0$ is a weight function and Z is the normalizing constant. With three classical weights

$$w(\lambda) = \begin{cases} e^{-\lambda^2/2}, & \lambda \in (-\infty, \infty), \quad \text{Gaussian,} \\ \lambda^\alpha e^{-\lambda}, & \lambda \in (0, \infty), \quad (\alpha > -1), \quad \text{Laguerre,} \\ \lambda^a (1-\lambda)^b, & \lambda \in (0, 1), \quad (a > -1, b > -1), \quad \text{Jacobi,} \end{cases} \quad (2)$$

the ensembles are called Gaussian beta ensembles, beta Laguerre ensembles and beta Jacobi ensembles, respectively. The three classical beta ensembles with specific values of β were originally known as the eigenvalues of random matrices: Gaussian orthogonal/unitary/symplectic ensembles (Gaussian weight, $\beta = 1, 2, 4$), Wishart/Laguerre matrices (Laguerre weight, $\beta = 1, 2$), and 'double Wishart' matrices (Jacobi weight, $\beta = 1$). However, they are now realized as the eigenvalues of certain tridiagonal random matrices for any $\beta > 0$.

In the regime where the parameter beta is proportional to the reciprocal of the system size, it is known that the empirical distribution of Gaussian beta ensembles (resp. beta Laguerre ensembles) converges weakly to a probability measure of associated Hermite polynomials (resp. associated Laguerre polynomials), almost surely. Gaussian fluctuations around the limit have been known as well.

In this talk, we aim to study a dynamical version of those results. More precisely, we study beta Dyson's Brownian motions and beta

Gaussian fluctuations for stochastic Volterra equations with small noise

Nguyen Thu Hang¹

¹ Department of Mathematics, Hanoi University of Mining and Geology, Ha Noi, Viet Nam
thuhangmdc@gmail.com

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Abstract:

In this paper, we consider a general class of stochastic Volterra equations with small noise. Our aim is to analyze the fluctuation of the solution around its deterministic limit. We use the techniques of Malliavin calculus to show that the fluctuation process satisfies central limit theorem and provide an optimal estimate for the rate of convergence. This talk is based on joint works with N. T. Dung.