

Universal Asymptotics through Orthogonal Polynomial Duality

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We present a new method to determine asymptotics in Markov processes, using orthogonal polynomial duality. This method allows for certain expected values to be decomposed over an orthogonal basis of duality functions in a "simpler" dual Markov process. Estimates for these expectations are then calculated in terms of estimates on the duality functions, which result in "universal" asymptotics. We demonstrate this method for asymmetric dynamic interacting particle systems, where there had not even been conjectures for asymptotics. These asymptotics are Tracy–Widom fluctuations for certain values of the asymmetry. We will also touch upon the algebraic and combinatorial structures underlying the probabilistic models.

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