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The coupling method for central moment bounds in exponential last-passage percolation

Last passage percolation (LPP) models, central to the Kardar–Parisi–Zhang (KPZ) universality class, are deeply connected to stochastic partial differential equations through scaling limits. In particular, the fluctuation behaviour of LPP models under appropriate scaling converges to the solution of the KPZ equation. In this way, LPP with exponentially distributed weights provides an exactly solvable discrete model whose asymptotics illuminate the behaviour of SPDEs with rough noise and nonlinear interactions.

I will discuss two variants of the exponential LPP model: the bulk model, where the last-passage environment is given by independent Exp(1)-distributed weights on the integer quadrant and the (two-sided) boundary model, where an additional layer of independent Exp(w)-distributed weights are placed on the horizontal boundary and independent Exp(1-z)-distributed weights on the vertical boundary, for $0 < w, z < 1$. A particular interest for the increment-stationary case ($w = z$) arises from the fact that then the distribution of the LPP increments is invariant under lattice shifts.

I will discuss how the coupling framework can be used to derive optimal-order upper and lower bounds on the central moment for these two variants of exponential LPP. That is, letting v be the LPP end-point we obtain bounds proportional to $\|v\|^{p/2}$ (CLT scaling) when v is close to the axis and to $\|v\|^{p/3}$ (KPZ regime) otherwise. These bounds are also uniform over vertices taking values in these regions.

The talk is based on joint work with Elnur Emrah and Nicos Georgiou.