

DYNAMICS OF THE BOX-BALL SYSTEM WITH RANDOM INITIAL CONDITIONS VIA PITMAN'S TRANSFORMATION

DAVID CROYDON (KYOTO UNIVERSITY)

The box-ball system (BBS), introduced by Takahashi and Satsuma in 1990, is a cellular automaton that exhibits solitonic behaviour. In a joint work with Tsuyoshi Kato (Kyoto University), Makiko Sasada (University of Tokyo) and Satoshi Tsujimoto (Kyoto University), we explore the dynamics of the BBS started from random initial conditions. In particular, we show that the model can be described using the transformation of a nearest neighbour path encoding of the particle configuration given by ‘reflection in the past maximum’, which was shown by Pitman to connect Brownian motion and a three-dimensional Bessel process. We use this to characterise the set of configurations for which the dynamics are well-defined and reversible for all times. We give simple sufficient conditions for random initial conditions to be invariant in distribution under the BBS dynamics, which we check in several natural examples, and we also investigate the ergodicity of the relevant transformation. Furthermore, we analyse various probabilistic properties of the BBS that are commonly studied for interacting particle systems, such as the asymptotic behavior of the integrated current of particles and of a tagged particle.