Blocks and Gaps
in the
Asymmetric Simple Exclusion Process

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Abstract

In earlier work with Harold Widom, we obtained formulas for the probability in the asymmetric simple exclusion process (ASEP) that the mth particle from the left is at site x at time t. These formulas were expressed in general as sums of multiple integrals and, for the case of step initial condition, as an integral involving a Fredholm determinant. In the present work these results are generalized to the case where the mth particle is the left-most one in a contiguous block of L particles. The earlier work depended in a crucial way on two combinatorial identities, and the present work begins with a generalization of these identities to general L.

For the KPZ regime with step initial condition, we determine the conditional probability (asymptotically as $t \to \infty$) that a particle is the beginning of an L-block, given that it is at site x at time t. Using duality between occupied and unoccupied sites we obtain the analogous result for a gap of G unoccupied sites between the particle at x and the next one.

This is joint work with Harold Widom.