

The totally asymmetric simple exclusion process in two-dimensional finite lattice, comparison of density profiles

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A two-dimensional model based on the totally asymmetric exclusion process is introduced. Its dynamics is inspired by pedestrian movement. We come out of the one-dimensional TASEP with open boundaries defined on a finite lattice of N sites. This model is solvable by means of the Matrix Product Ansatz method, which gives exact formulas for density profiles and phase diagram containing three phases, maximal current, low- and high-density phase; for both time continuous dynamics and discrete parallel updates. We define similar dynamics on a rectangle lattice of $M \times N$ sites with open boundaries. Several update procedures are discussed, and the permutation-parallel update is introduced. Via computer simulations the average density in steady state has been studied, and similar behavior to the one dimensional model has been observed. We have identified the same three phases and the same shape of the transition line between the low- and high-density phase. Finally, an idea of generalization for two particle species model is presented.