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Inhomogeneous Coupling in 2-Channel Asymmetric Simple Exclusion Processes KONSTANTINOS TSEKOURAS, ANATOLY KOLOMEISKY, Rice University — Asymmetric exclusion processes for particles moving on parallel channels with inhomogeneous coupling are investigated theoretically. Particles interact with hard-core exclusion and move in the same direction on both lattices, while transitions between the channels is allowed at one specific location in the bulk of the system. An approximate theoretical approach describing the dynamics in the vertical link and horizontal lattice segments exactly but neglecting the correlation between horizontal and vertical transport is developed. It allows us to calculate stationary phase diagrams, particle currents and densities for symmetric and asymmetric transitions between the channels. It is shown that in the case of the symmetric coupling there are three stationary phases, similarly to the case of single-channel totally asymmetric exclusion processes with local inhomogeneity. However, the asymmetric coupling between the lattices lead to a very complex phase diagram with ten stationary-state regimes. Extensive Monte Carlo computer simulations generally support theoretical predictions, although simulated stationary-state properties slightly deviate from calculated in the mean-field approximation, suggesting the importance of correlations in the system. Dynamic properties and phase diagrams are discussed by analyzing constraints on the particle currents across the channels.

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