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The Speed Process of the Totally Asymmetric Exclusion Process(TASEP)

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We study an exclusion process on Z where each particle is assigned a class (number in Z) and each particle tries to swap places with its right neighbor with rate 1 if that neighbor has a higher class number. (Alternatively, each edge of Z is "sorted" with rate 1) With the right starting conditions, the position of each particle (normalized by the time) converges to a constant speed. The speed of each particle is uniform in [-1,1], but there are strong dependencies between the behavior of different particles.

We study this exclusion process and the distribution of its related speed process. We show a new symmetry for the multi-type TASEP, and prove that the joint distribution of the speeds is stationary with respect to the multi-type TASEP dynamics (where the speeds are considered as the classes of the particles). This allows us to utilize known results on statinary measure for the multi-type TASEP to deduce various marginals of the speed process such as the joint distribution of the speeds for 3 consequative particles. Another suprising consequence is the existence of infinite "convoys"—particles (with different classes) all converging to the same speed. Some of our results apply also to the partially asymmetric case as well.

This is joint work-in-progress with Omer Angel and Benedek Valko from the University of Toronto.