Height fluctuations for the stationary KPZ equation

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The KPZ equation is believed to describe a variety of surface growth phenomena that appear naturally, e.g. crystal growth, facet boundaries, solidification fronts, paper wetting or burning fronts. In the recent years, serious efforts were made to describe the solution with different types of initial data. In the present work, we derive an explicit solution for the equation with stationary, i.e. two-sided Brownian motion initial condition. Our approach to the solution for the KPZ equation is via its representation as the free energy of a certain directed random polymer model. By providing contour integral formulas for the action of Macdonald difference operators, we characterize explicitly the free energy of the polymer model by giving a Fredholm determinant formula which is suitable for asymptotic analysis. In the limit leading to the solution for stationary initial condition, a random variable with exploding mean has to be removed from the directed polymer model and an analyitic continuation argument is used. In the large time limit of the solution, we recover the distribution obtained for the limiting fluctuations of the height function of the stationary totally asymmetric simple exclusion process (TASEP).
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