Traveling terrace solutions for nonlinear diffusion equations with spatially periodic coefficients

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abstract

We consider one-dimensional reaction-diffusion equations for a large class of spatially periodic nonlinearities – including multistable ones – and study the asymptotic behavior of solutions with Heaviside type initial data. Our analysis reveals some new dynamics where the profile of the propagation is not characterized by a single front, but by a layer of several fronts which we call a terrace. Existence and convergence to such a terrace is proven by using an intersection number argument, without much relying on standard linear analysis. Hence, on top of the peculiar phenomenon of propagation that our work highlights, several corollaries will follow on the existence and convergence to pulsating traveling fronts even for highly degenerate nonlinearities that have not been treated before.