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Bifurcations of self-similar solutions in slow diffusion equations

We consider the slow nonlinear diffusion equation subject to a strong absorption rate and construct local self-similar solutions for reversing (and anti-reversing) interfaces, where an initially advancing (receding) interface gives way to a receding (advancing) one. We use an approach based on invariant manifolds, which allows us to determine the required asymptotic behaviour for small and large values of the concentration. We then 'connect' the requisite asymptotic behaviours using a robust and accurate numerical scheme. We show that the self-similar solutions bifurcate from the time-independent solutions for standing interfaces. Such bifurcations occur when the confluent hypergeometric functions satisfying Kummer's differential equation is truncated into a finite polynomial. This condition specifies a countable set of admissible values for the parameters of slow diffusion and strong absorption. A two-scale asymptotic procedure allows us to deduce the asymptotic dependencies of the self-similar reversing interfaces near the bifurcation points. The asymptotic results are shown to be in excellent agreement with numerical computations.