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How travelling waves attract the solutions of KPP equations

Reaction-diffusion of the KPP (Kolmogorov, Petrovskii, Piskunov) type have a semi-infinite interval of travelling wave velocities, and our goal is to examine how this family of waves attract the solutions of the evolution equation. We will mainly concentrate here on super-critical waves, i.e., those having a velocity larger than the smallest one. Well-known results (Uchiyama 1978, Bramson 1983) assert that an initial datum consisting of a super-critical wave, perturbed by a compactly—or rapidly decaying—function, will give rise to a solution converging to the initial wave, exponentially in time.

We wish to examine what happens when this assumption on the initial datum is relaxed. The scenario is the following: an initial datum trapped between two waves of the same velocity will evolve into a travelling wave profile, but with a local phase shift that may not converge to anything as time goes to infinity. In other words, convergence to a single wave does not survive.

We will describe this phenomenon, explain why it happens, and discuss some generalisations to models that are inhomogeneous in the space variable.

Joint work with M. Bages and P. Martinez.