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Stability of travelling waves for time-delayed reaction-diffusion equations

This is the series of study on the stability of traveling wavefronts of reaction-diffusion equations with time delays. In this talk we will consider a local and nonlocal time-delayed reaction-diffusion equation, respectively. When the initial perturbation around the traveling wave decays exponentially as $x \to -\infty$ (but the initial perturbation can be arbitrarily large in other locations), we prove the asymptotic stability of all traveling waves for the reaction-diffusion equation, including even the slower waves whose speed are close to the critical speed. This essentially improves the previous stability results for the faster speed waves with small initial perturbation. The approach we use here is the technical weighted energy method, but the weight function is more tricky to construct due to the property of the critical wavefront, and the difficulty arising from the nonlocal nonlinearity is also overcome. Finally, by using the Crank–Nicolson scheme, we present some numerical results which confirm our theoretical study.