Controlling the position and shape of traveling waves

Jakob Löber [1], *Harald Engel* [1]

[1]Institut für Theoretische Physik, EW 7-1, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Germany

We present a method to control the position as a function of time of one-dimensional traveling wave solutions to reaction-diffusion equations according to a pre-specified protocol of movement. Given this protocol, the control function is found as the solution of a perturbatively derived integral equation.

Two cases are considered. First, we derive an analytical expression for the space (x) and time (t) dependent control function $f(x,t)$ that is valid for arbitrary protocol and for many reaction-diffusion systems. Second, for stationary control of traveling waves in one-component systems, the integral equation reduces to a Fredholm integral equation of the first kind. In both cases, the control can be expressed in terms of the uncontrolled wave profile and its velocity, rendering detailed knowledge of the reaction kinetics unnecessary. In two spatial dimensions, an extension of the proposed method allows to control the shape of traveling waves.