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Design of planar global attractors of Sturm type

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Abstract

We consider the global qualitative dynamics of the scalar reaction-advection-diffusion PDE on the unit interval. The equation combines a Morse variational structure, a nonlinear nodal property of Sturm type and, in the simplest case, a forced pendulum type equation for the equilibrium ODE. The global PDE attractor $\mathcal{A}$ consists of all equilibria and of heteroclinic orbits between them, only. The one-dimensional heteroclinic orbits between equilibria of adjacent Morse index define the edges of a finite graph. We give two equivalent geometric descriptions of these graphs in the planar case $\dim(\mathcal{A}) = 2$. One description is based on Hamiltonian paths in the graph. The other description is based on cycle-free orderings on the 1-skeleton. Examples include all planar attractors with up to 11 equilibria, and the Platonic graphs.

These results are joint work with Carlos Rocha; see also http://dynamics.mi.fu-berlin.de .