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Pavel Gurevich, Sergey Tikhomirov

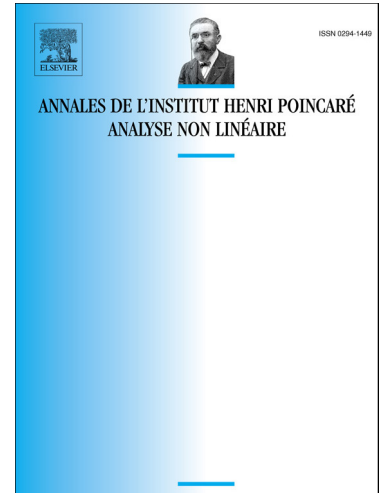
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Spatially discrete reaction-diffusion equations with discontinuous hysteresis

Pavel Gurevich*, Sergey Tikhomirov†

Abstract

We address the question: Why may reaction-diffusion equations with hysteretic nonlinearities become ill-posed and how to amend this? To do so, we discretize the spatial variable and obtain a lattice dynamical system with a hysteretic nonlinearity. We analyze a new mechanism that leads to appearance of a spatio-temporal pattern called *rattling*: the solution exhibits a propagation phenomenon different from the classical traveling wave, while the hysteretic nonlinearity, loosely speaking, takes a different value at every second spatial point, independently of the grid size. Such a dynamics indicates how one should redefine hysteresis to make the continuous problem well-posed and how the solution will then behave. In the present paper, we develop main tools for the analysis of the spatially discrete model and apply them to a prototype case. In particular, we prove that the propagation velocity is of order $at^{-1/2}$ as $t \rightarrow \infty$ and explicitly find the rate a .

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