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P1.2017 Dissipative shock structures in dispersive systems –application in multicomponent plasmas

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See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P1.2017.pdf

A generalized "hybrid" Korteweg - de Vries/Burgers (hKdVB) type partial-differential equation is considered. Although the model equation is known to arise in multi-fluid plasma models treated by multiscale (so called reductive perturbation) techniques [1], its generic form is considered in this work, carrying a broader focus and ambition for applicability in different models of dispersive systems (dynamics). The combined effect of nonlinearity and dispersion, in addition to diffusivity and dissipation, included via effective ad hoc terms, is taken into account.
An approximate analytical solution is obtained via a perturbative approach based on the hyperbolic tangent (tanh) method. Explicit shock-type solutions are obtained and analyzed, for different values of the relevant parameters. Various limiting cases are discussed.
A series of computational simulations based on an original numerical algorithm are then carried out, to test our analytical predictions. A critical comparison between analytical and numerical results reveals a very good agreement in the time-dependent shock amplitude, although the analytical method fails to reproduce the shock front steepening in time; it is argued that this is due to intrinsic limitations of the analytical method adopted. A train of soliton-like pulses, superposed over the shock-wave structure, also appears in computational simulations, when a large amplitude initial condition is considered.

References
[1] I. S. Elkamash and I. Kourakis, Physics of Plasmas, 25 (6), 062104 (2018); DOI: 10.1063/1.5029322.

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