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Traveling waves and spatio-temporal chaos in nonlinear dynamical systems

Nikolai Magnitskii

Abstract: The report will consider models of some physical, chemical and biological systems, described by nonlinear partial differential equations, such as the Ginzburg-Landau, Kuramoto-Sivashinsky, Schrödinger, FitzHugh-Nagumo equations, and having physical, chemical or biological turbulence regimes. It will be shown, that all such systems of partial differential equations can have an infinite number of different stable wave solutions, traveling along the space axis with arbitrary speeds, and also an infinite number of different states of spatio-temporal chaos (turbulence regimes). These chaotic (turbulent) solutions are generated by cascades of bifurcations of cycles or tori and singular attractors according to the universal bifurcation Feigenbaum-Sharkovsky-Magnitskii (FShM) theory in the three-dimensional or four-dimensional systems of ordinary differential equations, to which the systems of partial differential equations can be reduced by self-similar change of variables. 1. Magnitskii N.A. Universality of Transition to Chaos in All Kinds of Nonlinear Differential Equations, in “Nonlinearity, Bifurcation and Chaos - Theory and Appl.”, Chapter 6, edited by Jan Awrejcewicz, P. Hagedorn, Intech, Rijeka, 2012, p.133-174. 2. Magnitskii N.A. Bifurcation Theory of Dynamical Chaos, in “Chaos Theory”, Chapter 11, InTech, Rijeka, 2018, p.197-215.

[1)] Nikolai Magnitskii, Professor: Russian academy of science, Moscow state university, Bd. 114, Apt. 37, Leninskii Prospect, Moscow, 119415, Russia, Russia (RU), nikmagn@gmail.com.