Chaos in Deneralized Infinte Dimensional Dynamical Systems

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This paper considers qualitative analysis of infinite dimensional dynamical systems defined by partial differential equations with some initial conditions and free boundary conditions. To obtain an infinite dimensional dynamical system is still a main topic for any given p.d.e. problem. By the definition of the semi-group of operators, we know that a critical obstruction is the global uniqueness theorem of initial value problem. Infinite dimensional dynamical systems defined on some sets of Banach space and some energetic systems are introduced to handle certain problems which have no infinite dimensional dynamical system corresponded. Topological or functional classification of equilibria and the stability of equilibria are extremely important subjects in this field. Nontrivial limit sets other than equilibria and attractors or strange attractors (compact global attractors or universal attractors for the semi-group of operators) of infinite dimensional dynamical systems are introduced. Mathematical definition of chaos for infinite dimensional dynamical systems is given to explain certain physical, mechanical, or chemical phenomena governed by PDEs. Turbulence and chemical vibrations and other phenomena receive a good explanation in nonlinear mathematics. Some examples are discussed.

Keywords: infinite dimensional dynamical systems, free boundary conditions, steady state solutions, stability of limit sets, strange attractors, chaos, turbulence.