Abstract Details

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Title: (IWG6) A Thermodynamic Variational Principle in Nonlinear Systems Far From Equilibrium

Abstract:

A nonlinear dynamical system, when it is driven away from equilibrium, generally bifurcates from a homogeneous steady state either to a spatially homogeneous and temporally periodic state, or to a steady and spatially periodic state. When the system is driven further away from equilibrium in the latter case, a number of states with different spatial structures appears as metastable stable. It is an interesting and important question to ask which of them are mosst stable states. A possible answer to this question was proposed by the author1 using a thermodynamic argument which had led to the second principle of thermodynamics, according to which the entropy of a closed system always increases and achieves its maximum value in the thermal equilibrium state. By considering the nonlinear system and the its reservoirs as a closed system, one can argue with some conditions that the most stable steady state among the nonlinear dynamical system far from equilibrium should correspond to the one of maximum entropy production. Some numerical simulation for two model systems, a convection pattern2 and a chemical system3 supported the hypothesis. 1) Y. Sawada, ﷺA Thermodynamic Variational Principle in Nonlinear Non-Equilibrium Phenomenaﷺ, Progress of Theoretical Physics, 66(1981)215 2) M. Suzuki and Y. sawada, ﷺRelative stabilities of mertastable states of convecting charged-fluid systems by computer simulationﷺ Physical Review, A 27(1983)478 3) H.Shimizu and Y. sawada,ﷺRelative stability among metastable steady state structures in chemical rwaction systemsﷺ,J.Chemical Physics,79(1983)3828

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