Connection between the relaxation and sensitivity entropic indices: The case of z-logistic map family

Ugur Tirnakli

Department of Physics, Faculty of Physics, Ege University, 35100 Izmir-Turkey

By analysing the ensemble averages of the sensitivity to initial conditions and the entropy increase rates of the z-logistic map family at the chaos threshold, we numerically verify that the Pesin teorem is valid not only for cycle-2 but also for all other cycles that appear at periodic windows in chaotic region [1]. We also show, for the first time, that the two families of entropic indices q, namely, the one that comes from the properties of sensitivity to initial conditions (denoted by q_{sen}^{av}) [2] and the one that comes from relaxation dynamics (denoted by q_{rel}) [3] are related to each other through a simple scaling form, namely $q_{rel} - 1 \simeq A(1 - q_{sen}^{av})^{\alpha}$, where the positive numbers (A, α) depend on the cycle. Moreover, we find an unexpected and new scaling relation among the q_{sen}^{av} values of each cycle, namely $q_{sen}^{av}(cycle\, n) = 2.5\, q_{sen}^{av}(cycle\, 2) + \epsilon$ ($\epsilon = -0.03$ for $n = 3$, and $\epsilon = 0.03$ for $n = 5$).

[1] U. Tirnakli and C. Tsallis, Phys. Rev. E. 73 (2006) 037201.
[2] G.F.J. Ananos and C. Tsallis, Phys. Rev. Lett. 93 (2004) 020601.
[3] F.A.B. de Moura, U. Tirnakli and M.L. Lyra, Phys. Rev. E 62 (2000) 6361.