Effect of Temperature on Long Range Correlation

Sudeshna Lahiri[1], Dola RoyChowdhury[2], A.N.S. Iyengar[3] and M.S.Janaki[3]

1. Dinabandhu Mahavidyalaya, Bongaon, North 24 Pgs, Pin: 743235

2. Techno India, EM4/1, Sector V, Salt lake - 700091

3. Saha Institute of Nuclear Physics, 1/AF, Sector I, Salt lake- Pin: 700064

Abstract

A system is said to exhibit long-range correlations when some physical properties of the system are correlated at different times (or positions) and the corresponding correlation function decays much slower than exponentially as a function of time or distance. Oscillating reactions are best understood within the context of nonlinear chemical dynamics models that are used to predict the overall behaviour of complex systems. In this type of reaction, a mixture of chemicals goes through a sequence of colour changes, and this sequence repeats periodically. One of the best oscillating reaction is the Belousov-Zhabotinsky reaction. Hurst exponent is the most important parameter related to long range correlation. Effect of Concentration on long range correlation has been studied [1].

The purpose of the present study is to determine whether a long range correlation is present in BZ reaction and how this correlation varies with the change in temperature of the solution. To explore the dynamics of the system with change in temperature, raw signals, phase space plot and power spectrum are studied. Hurst exponent is estimated using log frequency vs log power plot and R/S technique. We discuss the results which uncovers how the system changes from a strange attracter to a limit cycle. Lyapunov exponent and correlation dimensions are also studied.

[1] “Long range correlations in Chemical Oscillations”, by D.Roy Chowdhury, S.Lahiri, A.N.S. Iyengar and M.S.Janaki, Journal of Controlled Science and Engineering, Vol.4, pp 95-101 (2016)