Graph Representation of Intermittent Chaos

Kenta Tanaka and Syuji Miyazaki

`Graduate School of Informatics, Kyoto University`

Based on a matrix representation of the generalized Frobenius-Perron operator describing large-deviation statistics of local expansion rates of one-dimensional chaotic map[1,2], directed graphs are constructed[3]. Its network statistics reflect characteristic fluctuation in the vicinity of a specific bifurcation. In this treatment, chaos can be described as an irregular switching between finite specific unstable periodic orbits. Type-I intermittency is analyzed for the solvable Shobu-Ose-Mori map[4] and the logistic map. Solvable irreducible and approximate redundant partitions are constructed to obtain directed graphs and degree distributions. The output degree distribution obtained from a redundant partition slightly fluctuates around that obtained from a irreducible partition in the case of a tent map. It is shown that the output degree distribution is a good candidate to capture characteristics of Type-I intermittency. Band crisis and on-off intermittency are also considered.

[1] H. Fujisaka and M. Inoue, Prog. Theor. Phys., **78** (1987), pp.268–282.
[2] H. Mori and Y. Kuramoto, Dissipative Structures and Chaos, Springer (1998).
[3] S. Miyazaki and Y. Higuchi, Forma, **28** (2013), pp.1–5.
[4] K. Shobu, T. Ose, and H. Mori, Prog. Theor. Phys., **71** (1984), pp.458–473.