Contributed Talk

Strange Nonchaotic Attractor in a Self-excited Turbulent Reactive Flow System

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Strange nonchaotic attractor (SNA) is an exotic state that is observed in dynamical systems, typically under external quasiperiodic or periodic forcing. In this talk, we present the discovery of SNA in a self-excited turbulent reactive flow system. We observe the state of SNA preceding the onset of periodic oscillations. We employ amplitude spectrum analysis and phase space reconstruction to delineate the observed dynamical states. Then, we use 0-1 test and correlation dimension analysis to characterize the state of SNA, followed by a singular continuous spectrum to confirm the state of SNA.

References

[1] C. Grebogi, E. Ott, S. Pelikan, and J. A. Yorke, "Strange attractors that are not chaotic," Physica D, vol. 13, no. 1-2, pp. 261–268, 1984.

[2] S. S. Negi and R. Ramaswamy, "A plethora of strange nonchaotic attractors," Pramana, vol. 56, pp. 47–56, 2001.

[3] J. F. Lindner, V. Kohar, B. Kia, M. Hippke, J. G. Learned, and W. L. Ditto, "Strange nonchaotic stars," Phys. Rev. Lett., vol. 114, Feb 2015.

[4] D. Premraj, S. A. Pawar, L. Kabiraj, and R. I. Sujith, "Strange nonchaos in self-excited singing flames," Europhys. Lett., vol. 128, feb 2020.

[5] P. Bryant, R. Brown, and H. D. I. Abarbanel, "Lyapunov exponents from observed time series," Phys. Rev. Lett., vol. 65, pp. 1523–1526, Sep 1990.