The influence of an external periodic force on the synchronization of pendulums

Tato Shervashidze [a] *, Ioseb Peikrishvili* [b]

e-mail: tato.shervashidze153@ens.tsu.edu.ge

e-mail: ioseb.peikrishvili302@ens.tsu.edu.ge

[a] Ivane Javakhishvili Tbilisi State University, Faculty of Exact and Natural Sciences 0179, I. Chavchavadze Avenue 3, Tbilisi, Georgia

The phenomenon of synchronization appears in many natural and technological systems, such as biological cells, neuronal networks of the brain, lasers and more. In this study, the collective dynamics of oscillators is analyzed within the framework of the Kuramoto model, which describes the interaction of oscillator phases through coupling and their response to external periodic force.

By varying the coupling strength and the amplitude of external forcing, we analyze, how external force affects the degree of synchronization and the spectral structure of the system.

Numerical simulations are conducted, the order parameter and spectral entropy are calculated, and a parameter map is presented that illustrates zones of regular and chaotic behavior depending on the values of forcing and coupling. The results reveal, that the amplitude of external forcing can significantly alter the level of synchronization in the system, which is important for the control and stability analysis of synchronized systems.

Literature

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