

Experimental Evidence of Community Switching

Taniya Khatun, Sapna Yadav, Heirtami Paswet and P. Parmananda

Department of Physics, Indian Institute of Technology Bombay, Mumbai, India

Complex networks are made up of communities wherein dynamics occur. Here, a community is defined as an ensemble of identical Wien-bridge oscillators that are nearly synchronized. We explore experimental evidence of community switching, i.e., a subset of oscillators in a community synchronizing their frequencies to those of the other community. We demonstrate this phenomenon by varying the network connectivity and interaction strength. Employing Wien-bridge oscillators, we study experimentally, as well as in LT spice simulations the phenomenon where an oscillator synchronizes its frequency to that of its neighboring community en route to global synchronization. Our results are in agreement with numerical simulations of the Kuramoto model reported by Kato and Kori in their novel work involving community switching [Phys. Rev. E. **107**, 014210 (2023)]. Due to the presence of noise, hysteresis is also observed in our experiment but not in LTspice simulations.

References

- [1] M. Kato and H. Kori, Partial synchronization and community switching in phase-oscillator networks and its analysis based on a bidirectional, weighted chain of three oscillators. Phys. Rev. E **107**, 014210 (2023).
- [2] M. Girvan and M. E. J. Newman, Community structure in social and biological networks Proc. Natl. Acad. Sci. **99**, 7821 (2002).