Design of OPCL coupling for arbitrary lag synchronization in chaotic oscillators

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Abstract

We discuss the method of arbitrary lag synchronization (ALS) in chaotic oscillators under unidirectional OPCL coupling. By ALS, we mean that any arbitrary lag time can be set between the driver and slave oscillators. The added advantage is that, one can precisely control the synchronization. LS is already reported in time-delayed systems by others [1] under unidirectional delay coupling. The limitation of such methods is their restriction on the amount of time lag. Recently, instead of using simple linear coupling other approaches [2, 3] are reported which increases the lag time for LS [2] or anticipating synchronization [3]. Although these methods enhance the lag time to an extent yet it remains restricted. In contrast, our proposed OPCL delay coupling is free from such limitation. One delay variable is introduced in the coupling term used in [4], which helps one target any ALS between the two-coupled chaotic oscillators. The delay time may be of the order of mean characteristic time scale of the system or even its multiples. Further, the method allows flexibility in controlling the lag time. We elaborate the method with numerical examples of Rössler system, a Sprott system and also with a neuron model namely the Hindmarsh-Rose model. Finally, we present experimental evidence of ALS in electronic circuit.

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