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Tempological Control: Stable Synchronization through Time-Varying Networks

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State-based negative feedback is a control strategy employed by built and natural systems alike to stabilize their dynamics around a desired state–everything from flocking birds to the synchronous rotation of power generators. Usually, this process requires continuous control input to counteract deviations from the target state, which can be invasive and demand considerable amount of energy. Here, for networked systems whose function relies on the synchronization of their components, we introduce "tempological" (temporal + topological) control– a noninvasive feedback control strategy that stabilizes synchronization without any control input. Instead, the scheme works by sporadic but deliberate alterations to the system's coupling network based on the system's dynamical state. We show that by strategically switching between different networks in this way, one can drive a set of oscillators to a stable, synchronous configuration even if *all* networks are individually unstable. We demonstrate the utility of our approach using both Kuramoto and Stuart-Landau oscillators, and establish theoretical guarantees on the success of "tempological control" in the thermodynamic limit.

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