Topologically-induced suppression of explosive synchronization on graphs

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The transition from a disordered state to the one in which all the nodes oscillates with the same phase typically occurs in a gradual way, which is char- acteristic of second order transitions. Therefore, the discovery of explosive syn- chronization on the networked Kuramoto model [1] when theres a correlationbetween degree (topological feature) and natural frequency (dynamical feature) marked a tipping point in this field.

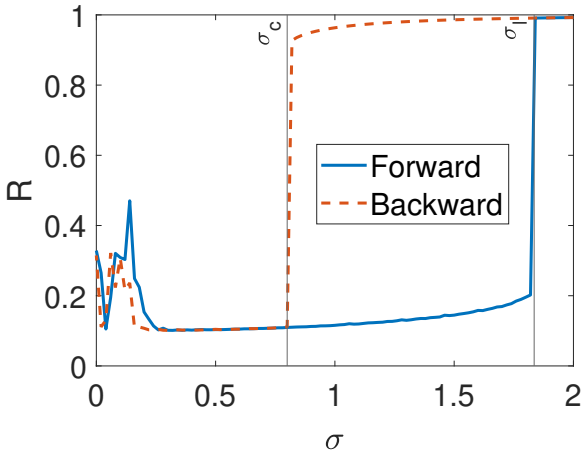

Fig. 1. Transition diagram on a star graph using the classic Laplacian.

For that purpose, we investigated how modifying the Kuramoto model by using degree-biased Laplacians [2] affects the explosive synchronization.

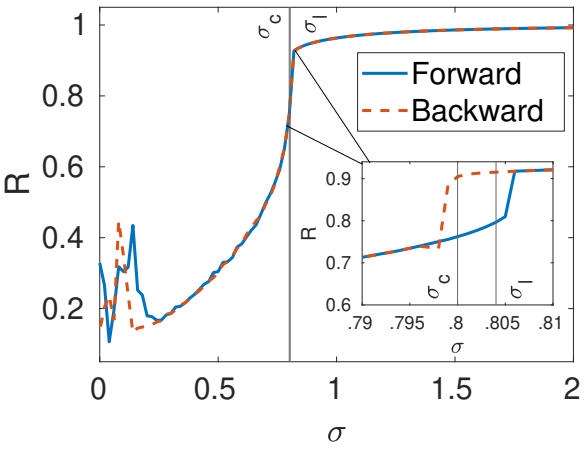

Fig. 2. Transition diagram on a star graph using the hubs-attracting Laplacian.

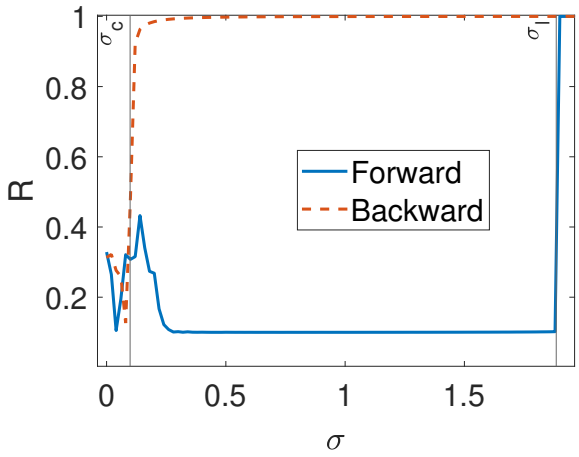

Fig. 3. Transition diagram on a star graph using the hubs-repelling Laplacian.

In this poster there will be shown the results in our latest article [3]. There we report how explosive synchronization is modified by these kind of operators, changing the points at which the transition occurs. Moreover, due to the heavy dependence between the operators and the network topology, we observed that the explosive synchronization happens on tree-like graphs, while it disappears for scale-free ones. Therefore, there is a transition between explosive synchronization in a branched acyclic system to normal one once cycles emerge in the system. This transition may represent a potential mechanism with which a neuronal system can synchronize explosively individual neurons, and returning to normal synchronization when the neuronal network is formed to avoid pathological states like epilepsy or chronic pain.

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