Title:	Are network properties consistent indicators of synchronization?
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Abstract:	We investigate the collective dynamics of bi-stable elements connected in different network topologies, ranging from rings and small-world networks, to random and deterministic scale-free networks. We focus on the correlation between network properties and global stability measures of the synchronized state, in particular the average critical coupling strength $\langle \epsilon_c \rangle$ yielding transition to synchronization. Further, we estimate the robustness of the synchronized state by finding the minimal fraction of nodes fc that need to be perturbed in order to lose synchronization. Our central result from these synchronization features is the following: while networks properties can provide indicators of synchronization within a network class, they fail to provide consistent indicators across network classes. For instance, the heterogeneity of degree does not consistently impact synchronization, as is evident through the stark difference in the synchronizability of rings vis-à-vis small-world and star networks, all of which have same average degree and deviation around the mean degree in the limit of large networks. Further we demonstrate that clustering coefficient is also not a consistent feature in determining synchronization. This is clear through the similarity of synchronization properties in rings with significantly different clustering coefficients, and the striking difference in synchronization of a star network and a ring having the same clustering coefficient. Even the characteristic path length, which is of paramount importance in determining synchronization, does not provide a one-to-one correspondence with synchronization properties across classes. Namely, synchronization is significantly favoured in networks with low path lengths within a network class. However, the same characteristic path length in different types of networks yields very different $\langle \epsilon_c \rangle$ and fc.
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