Abstract Submitted
for the NES21 Meeting of
The American Physical Society

Study on the Time-scale Separation in Communities Networks with Consensus Dynamics RICHARD KYUNG, HYUNGSOON HENRY KIM, CCRG-NJ — In this paper, dynamics, time-scales and communities were studied using graph theory. Simulations were performed by writing a code to simulate consensus dynamics on a network, and verify that the dynamics asymptotically converges towards a constant state. Adjacency matrix (unweighted) of a structured network with random groups was discussed in this research to study the consensus dynamics on this network which displays a time-scale separation. The presented code showed a plot of the vector set and x(t) and they converged to the average value after sufficient time steps. In contrast to the normal patterns, a greater time-scale separation was observed. This was because there were many less edges connecting the different communities: intuitively meaning the communities have less of an effect on each other, or that to have an effect it will take much more time. Increasing the number of random edges between communities i.e. the magnitude of the perturbation to the adjacency matrix of the three separate communitieswill reduce the time-scale separation, making it so that the communities reach the same consensus value at a certain time. Results show that until around t = 0:05, approximate consensus is reached within each group, then a consensus is reached between the groups.

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Date submitted: 10 Apr 2021 Electronic form version 1.4