



THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

Taming Complexity --- The Mathematics of Network Control

by

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Place: 106 Y. C. Liang Hall, CUHK

ALL INTERESTED ARE WELCOME

Abstract

The ultimate proof of our understanding of natural or technological systems is reflected in our ability to control them. Although control theory offers mathematical tools for steering engineered and natural systems towards a desired state, a framework to control complex self-organized systems is lacking. Here we develop analytical tools to study the controllability of an arbitrary complex directed network, identifying the set of driver nodes with time-dependent control that can guide the system entire dynamics. We apply these tools to several real networks, finding that the number of driver nodes is determined mainly by the network degree distribution. We show that sparse inhomogeneous networks, which emerge in many real complex systems, are the most difficult to control, but that dense and homogeneous networks can be controlled using a few driver nodes. Counterintuitively, we find that in both model and real systems the driver nodes tend to avoid the high-degree nodes.