

BI-CO MATHEMATICS COLLOQUIUM

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*“Modeling Thalamocortical Relay
Neuron, Parkinsonian Network, and
Deep Brain Stimulation”*

Monday, October 5, 2015

Talk at 4:00 – Park 338

Tea at 3:30 – Park 355, Math Lounge

Abstract:

We study a thalamocortical (TC) relay neuron model to examine the TC relay responses to an excitatory input train, under inhibitory signals. We first incorporate recording data as inhibitory signals to the TC model to investigate the mechanism underlying deep brain stimulation (DBS), which has been proven clinically effective to relieve motor symptoms for parkinsonian patients. Then we explore the closed-loop stimulation paradigm using a parkinsonian network model of the basal-ganglia thalamocortical circuit. To understand the different scenarios of TC relay responses, we further study the entrainment of the TC neuron to periodic signals that alternate between 'on' and 'off'. By exploiting invariant sets of the system and their associated invariant fiber bundles that foliate the phase space, we reduce the 3D TC model to a 2D map based on which we analyze the bifurcations of the entrained limit cycles.

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