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Boolean dynamics vs. ODE dynamics

The correspondence between systems of piecewise linear ODE's and their Boolean idealizations has been extensively studied by Leon Glass and his collaborators. These types of dynamical systems have been proposed as frameworks for studying biological processes such as gene regulation.

We consider a different class of ODE systems that naturally admit Boolean idealizations. The ODEs in this class have Lipschitz-continuous right-hand sides, and our class is rather broad. We assume that the variables can be grouped into agents of sorts, with individual agents having a certain bifurcation structure and inputs from other agents acting as changing bifurcation parameters.

This talk will present both simulations and analytical results that show how structural properties of the systems influence the degree of consistency between the ODE dynamics and its Boolean idealizations with synchronous or asynchronous updating. In particular, we explore to what extent features of chaotic dynamics in the Boolean idealization correspond to the presence of chaos in the underlying ODE system.