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2D Spatio-temporal Patterns in Coupled Phase Oscillators: Spiral Waves and Chimeras

Yujie Ding
University of Pittsburgh, yud39@pitt.edu

Bard Ermentrout
University of Pittsburgh, ermentrout@gmail.com

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It is now clear that much of what was once regarded as synchronous oscillatory dynamics in the brain actually takes the form of various types of spatio-temporal activity in the form of traveling waves and rotating waves. A natural platform for the modeling on the spatio-temporal dynamics of filtered LFP is phase equations, that is equations that govern the dynamics of the phases of networks of oscillators:

$$u_t = \omega(x) + \int_D W(x-y)H[u(y,t) - u(x,t)]$$

where $u(x,t)$ is the phase of the oscillator at a point $x \in D$, the two-dimensional domain. $W(x)$ is a coupling kernel and $H(u)$ is the phase-interaction function.

In this talk, I will discuss the existence and stability of rotating waves on annulus. I will show that as the inner radius shrinks, rigid rotating waves lose existence through a saddle-node bifurcation and this results in the birth of so-called chimeras.