Biology and Medicine Through Mathematics Conference 2023

May 17th, 3:30 PM - 5:30 PM

# Computing brain networks with complex dynamics

Anca R. Radulescu
*State University of New York at New Paltz*, radulesa@newpaltz.edu

# Computing brain networks with complex dynamics

Anca Rădulescu, SUNY New Paltz, radulesa@newpaltz.edu

One important question in neuroscience is how global behavior in a brain network emerges from the interplay between network connectivity and the neural dynamics of individual nodes. To better understand this theoretical relationship, we have been exploring a simplified modeling approach in which we equip each node with discrete quadratic dynamics in the complex plane, and we study the emerging behavior of the resulting complex quadratic network (CQN). The long-term behavior of CQNs can be represented by asymptotic fractal sets with specific topological signatures going far beyond those described in traditional single map iterations.

We illustrate how topological measures of these asymptotic sets can be used efficiently as comprehensive descriptors and classifiers of dynamics in tractography-derived connectomes for human subjects. We show to what extent the complex geometry of these sets is tied to network architecture (on one hand) and to the network behavior (on the other). We discuss how this helps us understand the mechanics of the relationship between the subject's brain function, physiology and behavior and their underlying connectivity architecture.