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Comparison of Synchronization in Small World and Random Networks TESS BERNARD, BRUCE MILLER, Texas Christian University — There are many models that simulate neuron firing in the brain. These range from the basic integrate-and-fire method to the complex Hodgkin-Huxley model. Eugene Izhikevich (2003) employed the principles of nonlinear dynamics, specifically bifurcation theory, to develop a model that is both simple and powerful, which can be described as an integrate-and-reset model. By changing only a few parameters, this model can simulate all the known types of cortical neuron firing patterns. Using it, we studied the properties of two different types of neural networks. In the first, originally used by Izhikevich, the synaptic connection strengths between the neurons are determined randomly, and each neuron is connected to all of the other neurons in the network. The second is a small world network modeled after the one employed by Alex Roxin, et al. (2004), but expanded to include inhibition. This geometry is an idealized representation of the nervous system. In our investigation we compared the onset of synchronization in each network, as well as its stability in the presence of external currents. We also considered the relevance of these results to real world phenomena such as seizures.

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