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A model of spatiotemporal desynchronization for seizure control

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Contemporary approaches to controlling bursting behavior in brain slice models of epilepsy have typically emphasized spatially simplified strategies such as uniform DC fields or chaos control techniques using a single stimulating electrode. While such approaches have produced some promising results in these models, the recent development of multielectrode stimulating array systems for neuroprosthesis applications suggests that spatiotemporal approaches to controlling seizures *in vitro* may present opportunities for more flexible and robust control of ictal activity in slice models (as well as in potential clinical applications). We investigate several such control strategies in a spatially distributed model network of integrate-and-fire neurons based on Izhikevich's Simple Model [1]. This model was designed to mimic neocortical networks consisting of interconnected excitatory and inhibitory neurons. We show that waves of synchronous activity within the model can be blocked by regions of spatiotemporally asynchronous firing mimicking activity that could reasonably be generated by a microstimulation array. This desynchronization of seizure-like activity can be produced over a range of stimulation parameters and in networks with mixed or purely excitatory connections, suggesting that these effects may also be reproducible in neocortical slices *in vitro*.

References

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