

Employing dynamical systems theory to study neural activity

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Mathematical neuroscience is a highly interdisciplinary field that harnesses the power of mathematics to solve important problems in neuroscience. Mathematical models serve as testing grounds for theories of how the brain works, or does not work in neurological disorders like epilepsy and Parkinson's disease. Despite the immense complexity of the brain, such models have allowed for major advances to be made towards understanding behaviour, consciousness and disease.

This project requires a background in dynamical systems and computational modelling, and a keen interest in neuroscience. The project will begin with a literature review of current mathematical models of the brain. During this time, the student will develop their mathematical and computational modelling skills, as well as learn about numerical bifurcation analysis. The project direction will then be decided based on the interests and skills of the student.

The two books listed below provide a good introduction into mathematical neuroscience.

References

- [1] G. B. Ermentrout; D. H. Terman, *Mathematical Foundations of Neuroscience*, Springer, 2010.
- [2] E. M. Izhikevich, *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*, MIT Press, 2007.