Msc thesis
Mathematical Modelling and Computation

# The dynamics of adaptive neuronal networks: influence of topology on synchronisation

Simon Aertssen, s181603

*Supervisors*
Erik Martens and Poul Hjorth

February 1st 2021

DTU Compute
Department of Applied Mathematics and Computer Science

DTU

## Contents

1. Introduction

2. The Theta Neuron Model

3. Network Topologies

4. Mean Field Reductions

5. *Investigation:* Mean Field Reductions for undirected graphs

6. Hebbian Learning and Synaptic Plasticity

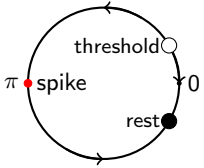
7. *Investigation:* Emerging Network Topologies

8. Conclusion and Discussion

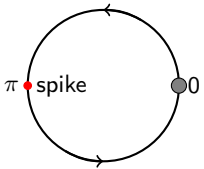
# Introduction

# The Theta Neuron Model

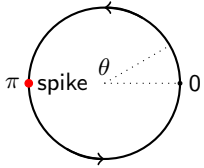
- SNIC bifurcation




Excitable regime: $I < 0$

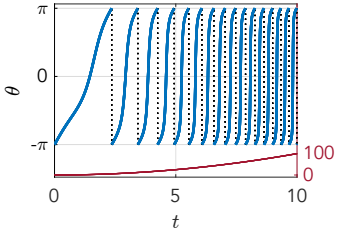


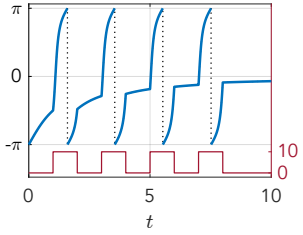

Bifurcation: $I = 0$

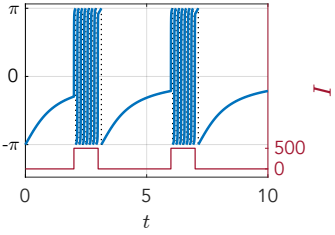



Periodic regime: $I > 0$

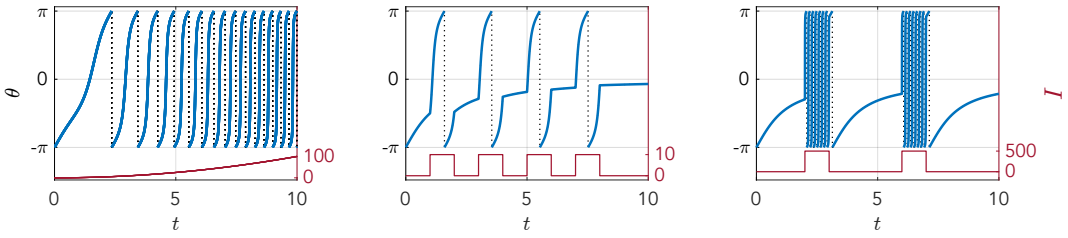
Features of the model



# The Theta Neuron Model



# Network Topologies

# Mean Field Reductions

## *Investigation:* Mean Field Reductions for undirected graphs

# Hebbian Learning and Synaptic Plasticity

# *Investigation:* Emerging Network Topologies

# Conclusion and Discussion