

# GSURC Poster Presentation Proposal

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## 1 Title

Quantitative and Qualitative Stability Analysis of Polyrhythmic Circuits

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## 4 Abstract

### 4.1 Introduction

In many applications, circuits of relaxation oscillators are used to model behavior in an oscillatory system. The main motivation for this research is the application of simplified networks of relaxation oscillators to neurons. Many neuronal models are complex, and thus computationally expensive. We wish to show the simplified model we use exhibits similar dynamics as the more complex networks, to simplify study of neuronal behavior.

### 4.2 Method

In this study we use a novel qualitative method of plotting basins of attraction of stable fixed points, in order to find polyrhythmic stability as well as network bifurcations with parameter variations. We also highlight a method used previously in a different model, and show its advantages and disadvantages.

### 4.3 Results

The multiple approaches taken in the study all yield the same results, validating our qualitative analyses of these circuits. We have various forms of bifurcations in the network that all correspond to different parameter changes, that are detected in the qualitative analysis, as well as the quantitative and using a combination of the methods, we can now predict when a bifurcation will occur in the network.

### 4.4 Conclusion

Using the knowledge of the polyrhythmic behavior these network exhibit, we can focus on figuring out algorithms for learning, and enforcing specific behavior. Also, future analysis of larger networks, and different models is now simplified with our novel qualitative methods.