UNIVERSITY OF THE PHILIPPINES BAGUIO

Bachelor of Science in Mathematics

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Announcement of the Bachelor's Thesis Examination

of

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and
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in their Thesis
Insert Title of Your Thesis

for the degree of
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9 June 2024, Thursday 3:00 PM
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This Undergraduate Thesis is hereby officially accepted as partial fulfillment of the requirements for the degree of Bachelor of Science in Mathematics.

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Abstract

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This is the content of the Abstract.

Acknowledgments

Thank you.

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Chapter 1

Introduction

Cells of the sinoatrial (SA) node of the heart fire impulses in synchrony to help the atria contract. [1, 5].

Chapter 2

Preliminaries

A discourse on the background of the study is in this chapter. We divided this chapter into three parts.

2.1 Basic Concepts on Synchronization

We will use mainly the definitions from the book of Hoppensteadt and Izhikevich [3], and Pikovsky et al. [4] and adapt some terms in the current literature.

Definition 2.1.1 (Phase Synchronization (PS)) A set of coupled oscillators is said to achieve *phase synchronization* (or *synchronized in phase*) if there exists a time t_0 such that

$$|\theta_m(t) - \theta_n(t)| = 0, \qquad n, m \in \mathcal{V}, \quad \text{for all } t \geq t_0,$$

Chapter 3

Dynamic Theory of Modified Models

Our results focus on the long-term dynamics of the systems.

3.1 On Modified Kuramoto Model

In this section, we consider the following Kuramoto Model

$$\dot{\theta}_n(t) = \omega_n + \frac{\kappa}{N}\sum_{m=1}^{N} \sin(\theta_m(t) - \theta_n(t)). \tag{3.1}$$

Chapter 4

Numerical Simulations

In the course of the discussions of our analytical results.

4.1 Asymptotic Frequency Synchronization

We see here that the approximation error is less than 10^{-11}.

Table 4.1. The table above shows the maximum values of g

r	γ_{exp}	$g(\gamma_{\text{exp}})$	$M(\gamma_{\text{exp}})$	r	γ_{rat}	$g(\gamma_{\text{rat}})$	$M(\gamma_{\text{rat}})$
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

We can see from the following values of r in Table 4.1. that $M(\gamma) < g(\gamma)$ for coupling function f.

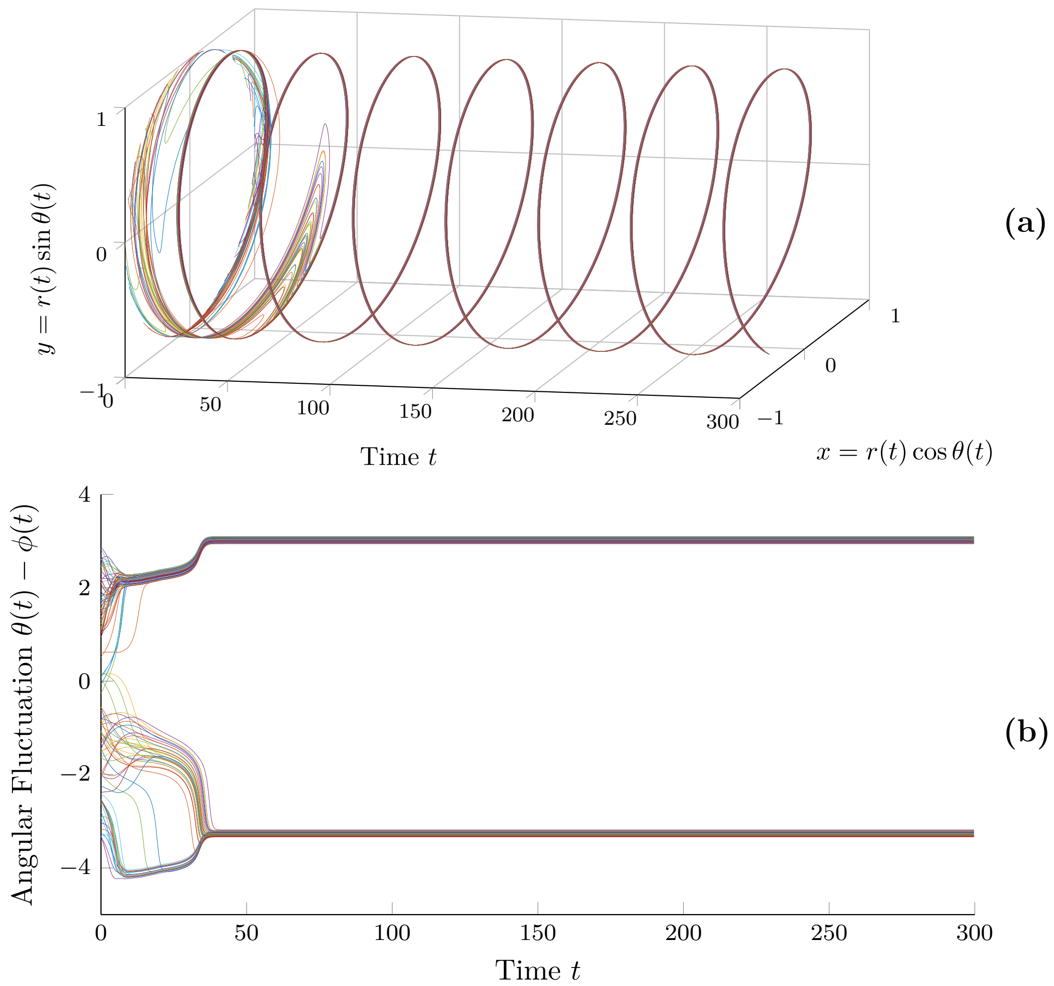

Figure 4.1. The above figures show Asymptotic Frequency Synchronization of modified Kuramoto Model with exponential coupling function.

Chapter 5

Conclusions and Future Work

5.1 Summary and Conclusions

Conclusion

5.2 Recommendations for Future Works

Future Works

Appendix A

Notations

A.1 Basic

A.2 Functions

Appendix B

Notes on Other Theorems

We extend their result by considering a system.

Remark B.0.1 *The theorem in [2] follows by taking* $\hat{\mathbf{r}} = (1, \ldots, 1)^T$ *in the previous theorem.*

List of References

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