2022 Future Computing Summer Internship Project: Detecting if simulated oscillators are following the Kuramoto Model by determining if the oscillators experience synchronization.

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Abstract

1 Project Description

The challenge addressed by this work is to determine a correct and efficient way to analyze multiple oscillators and determine which oscillators are synchronized and which are not. The purpose for this is to detect synchronization of oscillators in simulation. This problem is being looked at due to the Kuramoto Model, which is a mathematical model that describes how coupled oscillators may synchronize over time. If this behavior is unintended and system architects are unaware of it, this can become a problem. In this case, an effort is put forward to detecting which oscillators are synchronized in a set and which are not.

2 Motivation

3 Prior work

Will properly explain these works later:

- Method of detecting synchronization by measuring peak synchronization in multiple signals [2]
- Method of detecting synchronization by defining events (such as peaks in signals) and does not require the calculation of phase [3]
- Comparison of multiple current methods for phase synchronization [1]

4 Running the Model

5 Result

W.I.P.

6 Future Work

W.I.P.

References

[1]

[2] Rahul Biswas, Koulik Khamaru, and Kaushik K. Majumdar. A peak synchronization measure for multiple signals. *IEEE Transactions on Signal Processing*, 62(17):4390–4398, 2014.

[3] R. Quian Quiroga, T. Kreuz, and P. Grassberger. Event synchronization: A simple and fast method to measure synchronicity and time delay patterns. *Phys. Rev. E*, 66:041904, Oct 2002.