

Synchronization hypothesis in the Winfree model

Walid OUKIL^{1,2}

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Email : oukil.walid@gmail.com

Abstract

In 1967 Arthur Winfree proposed a model describing the synchronization of a population of organisms or *oscillators* that interact simultaneously as , the neurons, the circadian pacemaker cells, and other biological populations and describing the circadian rhythm . The Winfree model is one of the coupled mean-field systems with an independent-time perturbation. We present a hypothesis for which we can find such synchronization in the Winfree model. We show analytically the existence of synchronized oscillators when this hypothesis is satisfied and when the perturbation is small. In addition we show the existence of periodic oscillators with the same rotation number. We give a numerical counter-example which shows that this hypothesis is necessary for the existence of synchronization also without perturbation of model.

Keywords: Coupled oscillators, Winfree Model, synchronization, desynchronization, periodic orbit

¹Institute of Mathematics of Bordeaux (IMB), University of Bordeaux, 351, cours de la Liberation –F 33 405 TALENCE, France.

² Faculty of Mathematics. University of Sciences and Technology Houari Boumediene, BP 32 EL ALIA 16111 Bab Ezzouar, Algiers, Algeria