

Synchronization Phenomena in van der Pol Oscillators Coupled by a Time Varying Resistor

Yoko Uwate[†] and Yoshifumi Nishio[†]

[†] Department of Electrical and Electronics Engineering
Tokushima University
2-1 Minami-Josanjima, Tokushima, Japan
Phone:+81-88-656-7470, Fax:+81-88-656-7471
Email: {uwate, nishio}@ee.tokushima-u.ac.jp

Abstract

There have been many studies of synchronization phenomena of coupled oscillators. Many researchers suggest that synchronization phenomena of coupled oscillators have some relations to information processing in the brain. We consider that it is very important to investigate the synchronization phenomena of coupled oscillators to realize a brain computer for the future engineering application.

In this study, synchronization phenomena observed in van Der Pol oscillators coupled by a time varying resistor are investigated. We realize the time varying resistor by switching a positive and a negative resistors periodically. By carrying out circuit experiments and computer calculations, extremely interesting synchronization phenomena can be confirmed to be generated in this system. In the case of two coupled oscillators, the oscillators tend to synchronize at in-phase when the frequency of switching resistor is lower than about 5kHz. However, they tend to synchronize at anti-phase when the frequency of switching the resistor is set to higher than 5kHz. Namely, the synchronization states change according to the switching frequency of the time varying resistor. Further, we investigate the influence of the duty ratio of the switching, namely we vary the ratio of time intervals connecting to the positive and the negative resistors. Various interesting features of the coupled system can be clarified.