

AMPLITUDE EFFECTS OF NETWORK SYNCHRONIZATION OF COUPLED LIMIT-CYCLE SYSTEMS

Tingxian Zhang^{1,2} and Zhigang Zheng^{1†}

¹Department of Physics
Beijing Normal University, Beijing, 100875, P. R. China

²Department of Physics
Qijing Teachers College, Qijing, 65500, P. R. China

Abstract. We reviewed recent studies on the effects of amplitude on synchronization in coupled limit-cycle systems. Phase synchronization among oscillators exhibiting a tree-like bifurcation and a number of clustered states are experienced. The phase synchronization bifurcation is accompanied by a bifurcation process of the amplitudes of the oscillators, i.e., the synchronization of phases corresponds to an inhomogeneous process of the amplitudes.

Keywords. limit-cycle, synchronization, bifurcation, coherence, amplitude effect, amplitude death, network

1 Introduction

Synchronization is one of the most important phenomena in biology [1 ~ 3] and physics [4 ~ 13]. The synchronization of coupled limit-cycle systems is the most basic concept in many fields such as science, nature, engineering, social life, etc. The phenomenon of synchronization was first observed among man-made facilities. In recent years, the focus on synchronization was shifted to the synchronization of systems in biology. Examples include diverse cooperative activities of insects, animals and human beings such as a population of spontaneously active neurons, synchronous firing of cardiac pacemaker cells, and groups of people whose menstrual cycles become synchronized. There are two methods being used in studying the synchronization phenomena. The first is the statistical method which investigates macroscopic behaviors of the systems in the thermodynamic limit. The second method is the dynamical method that focuses on dynamical features of the systems with a finite number of oscillators.

In the past few years, the study of complex networks has gained increasing attention [11 ~ 13]. Networks of coupled dynamical systems have been used

^{1†} Corresponding author: <gzgheng@bnu.edu.cn>