THESE du Dr CHEMBO

Titre: Contribution for the exploitation of coherent and incoherent nonlinear phenomena in telecommunication

Abstract:

The purpose of this thesis is to study the phenomena of synchronisation and pattern formation in lattices of chaotic oscillators in view of applications to cryptography and switching in telecommunications. This work is divided in four chapters.

In the first chapter, we perform the optimization and stability analysis for the synchronisation of coupled chaotic oscillators. We use the Floquet theory to determine optimal synchronisation conditions for coupled system. We also study the neighboring cases of delayed synchronisation and external feedback control.

In the second chapter, the study is extended to the problem of pattern formation in one-dimensional lattices of diffusely coupled chaotic oscillators. We first focus on the case of a low dimensional ring, and then generalize the obtained results to lattices of arbitrary dimension.

Chapter III focuses on the dynamics and synchronisation of chaotic semi conductor lasers. The two cases of current-modulated and external-cavity semiconductor lasers are considered, and the stability of their related synchronisation manifolds is investigated. In both cases, the issue of parameter mismatch is also addressed.

The last chapter is devoted to the application of the observed coherent and incoherent nonlinear phenomena to cryptography and switching in optical-fiber telecommunication networks. We first ensure the secure encryption of digital messages with hyperchaotic carriers, and we secondly exploit the phenomenon of cluster synchronisation in shift-invariant lattices of chaotic semiconductor lasers to perform the switching in these chaos-secured networks.