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TITLE OF THE THESIS: *Dynamics in networks of semiconductor lasers and applications*

Abstract:

In this thesis, we study the dynamics of networks of semiconductor lasers and give some applications.

Several concepts for understanding laser principles in general are presented, and in particular, the case of semiconductor lasers is widely considered. Various types of lasers are presented, depending on the nature of the active material. Their specific applications are mentioned and a general mathematical description of the laser is presented.

Semiconductor lasers are further investigated, and we are concerned with their dynamics in networks. First, analytical and numerical treatments are used to demonstrate the cluster synchronization type *aba*b in a network of semiconductor lasers with optical feedback. The issue of parameter mismatch on the synchronization is addressed, and the stability of the related synchronization manifolds is investigated. Further, the full synchronization in networks of ultra-high frequency current modulated semiconductor lasers is presented. The cases of mutually symmetric and asymmetric delay coupling are considered. As for the latter, we analyse the power emitted by the network in terms of the number of lasers, the frequency of the current and in terms of mutual and global coupling coefficients.

Key words: *semiconductor lasers, chaos, synchronization, coherence, light intensity*