Chapter 1

INTRODUCTION

1.1 INTRODUCTION

Due to large and increasing amount of traffic over telecommunication networks is the burst Internet traffic. Moreover, multimedia applications, which include different service types with time-variant data rates, have had a rapid growth in recent years. Therefore, multirate/multiservice (MR/MS) schemes for optical CDMA are of crucial importance for future all-optical networks. Where Optical networks have been supported high bandwidth, which covers the high data rates required by modern networks and communication systems. The optical code-division multiple-access (CDMA) technique appears as a promising method that can mine this huge bandwidth [13]. In contrary to conventional schemes like wavelength division multiplexing (WDM) and time division multiplexing (TDM), OCDMA offers attractive features like asynchronous access, privacy and security in transmission, ability to support variable bit rates, lower cost and scalability of the network, which makes it the best candidate for a multi access scheme in current and future access networks [14].
In an incoherent OCDMA system, each user is allocated a unique signature sequence, selected from a family of 0/1 sequences, that satisfies certain correlation properties. These signature sequences are referred to as optical orthogonal codes (OOCs) [4, 7, 8].

Adopting multi-coding techniques in OCDMA networks would require a set of large number of signature sequences, which is not available in one-dimensional optical orthogonal codes (1D OOCs). In fact, increasing the cardinality in OOCs means increasing the code length, which is not practical for high bit rate applications where the number of time slots is limited. To overcome the shortcoming of 1D OOC, we adopt two-dimensional optical orthogonal codes, which extends the cardinality to a larger set. Specifically, a 2D one-coincidence frequency hop code (2D OCFHC/OOC) supports very good cardinality and has excellent correlation properties [14].

1.2 OBJECTIVE OF THESIS

In the present work, multi-rate on optical code division multiple access (OCDMA) network based on multi-coding techniques is applied and study the performance of the network. Two different link layer protocols are used which are modified in own analysis. The objective is to allow users of different data rates to access the network simultaneously without affecting or reducing the network performance. The performance of these protocols is evaluated in terms of the system throughput, and the average packet delay.

1.3 ORGANIZATION OF THESIS

The organization of this thesis is as follows:
Chapter 2 shows efforts of some researchers using multi-rate techniques with OCDMA communication systems.
Chapter 3 presents the background and basic information of optical communications including: introduction about OCDMA, concept of Optical Orthogonal codes OOCs, various optical CDMA receivers with their analysis, the need for multi-rate transmission, short review about the three basic types of multi-rate techniques, and concept of 2D OCFHC/OOC. Finally, we define two optical CDMA random access protocols.
Chapter 4 can be regarded as the major part of the thesis. It presents the basic model and analysis, which extend two random-access protocols for the OCDMA network proposed in [3] for single-rate users to be suitable for multi-rate users and adding effect of noise to multiple access interference (MAI).
Chapter 5 represents the obtained results and discussions. It also shows the system performance with MAI only for two classes and general number of classes networks respectively and the performance of the network in presence of MAI with shot and thermal noises separately for general number of classes network.
Finally, **Chapter 6** gives the main conclusions of this work and recommends subjects for future research in the same scope of thesis, followed by a list of the references used through out this work. The thesis is terminated by an Arabic summary.