

ABSTRACT

Telecommunications is a vital and growing area, important not only in its own right, but also for the services it provides to other areas of human endeavor. Moreover, many new multimedia applications based on the Internet and services such as Voice-over-IP (VoIP), videoconferencing, TV over the Internet, radio over the Internet, multipoint video streaming, etc. demand resources like broader bandwidth, low latency, small packet loss ratio, and so on. The most prominent solution to meet the skyrocketing needs of all these applications is to use Optical networks using wavelength division multiplexing (WDM), which provide bandwidths of the order of terabits per second, in addition to having negligible loss and very low bit error rates. The work reported in this thesis focuses on third generation optical networks where, WDM is utilized to fully exploit the unlimited bandwidth of the optical fiber. Moreover, the transmitted data remains in the optical domain all along the path, providing a greater transparency in the process. The WDM based optical networks can be classified broadly into two categories, namely broadcast-and-select networks and wavelength routed networks. The wavelength routed networks are currently being deployed as high speed Internet backbone network.

This thesis reports investigations on one of the most complex optimization problems encountered in optical circuit switched wavelength routed networks, that is, QoS aware or Impairment aware dynamic routing and wavelength assignment (DRWA) problem. Specifically, a class of metaheuristic based algorithms, known as Evolutionary programming algorithms, have been proposed for routing of multiple concurrent requests in a telecommunication network and for solving the DRWA problem under the assumption of an ideal physical layer as well as in the presence of linear and non linear impairments such as amplifier noise, noise due to switch crosstalk, demultiplexers crosstalk, and four wave mixing (FWM) crosstalk. The superiority of the proposed algorithms is established by estimating performance measures such as the mean blocking probability and the average execution time.

Keywords: Metaheuristics, Evolutionary programming algorithm, WDM networks, DRWA problem, Survivable DRWA problem, Wavelength assignment approaches, QoS routing, Fitness function, QoT aware DRWA problem, Linear impairments, Nonlinear impairments, Four wave mixing, Bit error rate.