Semiconductor Optical Amplifiers

Motivation for Semiconductor Optical amplifiers includes the need to remove the bottleneck inherent in the Electrical-Optical interface, providing a more cost effective solution to regenerative repeater, increasing distance and number of network user, and realizing an all optical system. This bottleneck limits the performance of the overall system because simply put, the electrical devices aren’t capable of operating at faster speed. However, semiconductor optical amplifier alleviates this situation by allowing the operations of amplification and other electrical type operations to be carried out entirely in the optical domain. This eliminates the need to use costly and complex regenerative repeaters, which translate to a tremendous cost saving opportunity.

There are two main approach to optical amplifier. There are the semiconductor optical amplifiers (SOA) or laser amplifier, and then there are the fiber amplifier. Laser amplifiers are very much like laser in that they utilizes stimulated emission from injected carriers, while fiber amplifiers get the gain through stimulated Raman or Brillouin scattering or by rare earth dopants. There are two main condition for an semiconductor optical amplifier, first it must be bias just below oscillation threshold and second it must have a low facet reflectivity to suppress cavity resonance.

Some of the advantages of SOA includes the fact that they are very small and inexpensive, compared to fiber amplifier which are quite large and rather expensive. They’re also extremely flexible in terms of wavelength, have low power consumption and fast turn on time. All of these properties make semiconductor optical amplifiers prime candidate to act as optical switches, modulator, or pulse generator. They’re also widely use in applications such as WDM/TDM systems, cable television network, and as wavelength converter system. Overall, SOA have such wide applications that they can be used alone as simple amplifiers are integrated together in larger system. Semiconductor Optical amplifiers provides the means to which we can one day realize the potential of an all optical system. By being able to operate entirely in the optical domain, we can improve the response or speed of the network, as well as the full bandwidth.