Ultra-wideband SOA fibre laser generation

Nor Ahya Hassan
University of Malaya, Malaysia

A comprehensive study of a ultra-wideband semiconductor optical amplifier (SOA) has been conducted throughout this thesis upon generating ultra-wideband fiber lasers of various attributes. The fundamental characteristics of the ultra-wideband SOA such as the gain and noise figure (NF) are successfully investigated in the prior part of the thesis by utilizing the conventional method of measurement. A result of high gain with small NF drawbacks, covering three communication bandwidth regions of more than 120nm, of short (S-), conventional (C-) Band and long (L-) Band is achieved. The ultra-wideband coverage of the telecommunication bandwidth has made the ultra-wideband SOA a promising candidate to rule out the utilization of the costly rare earth doped fibres that dominates the communication industry nowadays. Next Characterization technique of double-pass configuration of the ultra-wideband SOA also has attained attractive results on gain and NF values. This Characterization is crucial in later experiments of ultra-wideband SOA fibre laser generation.

The ultra-wideband fibre lasers are realized by utilizing three techniques of experimental configurations; by using arrayed-waveguide grating (AWG), by using three wavelength selective filters of fibre Bragg gratings (FBGs), and by applying nonlinear effect in the optical fibre of stimulated Brillouin Scattering (SBS) effect. The First method using AWG Produces a 16-channel System of an ultra-wideband multi-wavelength SOA Fibre laser. The occurrence of a single wavelength signal of every S-, C- and L-band Simultaneously for every selected channel, has been the main highlight of this laser configuration. Other than that, this configuration also has the favorable factor of wavelength tenability within the aforementioned bandwidth range. The Next method that deploys three fibre Bragg Gratings (FBGs) of each S-, C- And L-band as the wavelength selective filters produces three simultaneous signal wavelength of 1500 nm, 1540 nm and 1580 nm with maximum peak power of --6 dBm in S-band, --11 dBm in C-band and --10 dBm in L-band, along with high average signal-to-noise ratio values exceeding 60 dB at the maximum drive current of 390 mA. The Proposed system would find many applications where a wide-band and stable laser source is crucial, such as in communications and sensing. The Third method deployed is by applying nonlinear effects into a high nonlinear fibre of dispersion compensating fibre (DCF). This Experimental configuration yields three sets of multi-wavelength laser comb of S-, C- and L-band simultaneously, with about 0.08 nm wavelength spacing (equals To 10 GHz In frequency frame) in each wavelength comb. This System has the advantage of the ability to supply for many wavelength signals at a time, which is highly demanded in the dense wavelength division multiplexing (DWDM) System application. All The three ultra-wideband SOA Fibre laser systems are tested for stability tests of 70 Minutes duration running time. This is to prepare for a stable fibre laser system into the network applications.

nour.ahya@gmail.com