A novel method of increasing the range of 1.65μm OTDR using a Q-switched Erbium fibre laser
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This paper demonstrates a novel method of increasing the range of a 1.65μm optical time domain reflectometer system (OTDR). OTDR measurements at 1.65μm are more sensitive to fibre macro and micro bending losses than those produced at wavelengths 1.3 and 1.55μm. This enables problems to be identified in their early stages reducing the risk of total system failure. However, the dynamic range of current 1.65μm OTDR systems is limited by the power of the available laser diodes.

Recently we have developed a high power 1.65μm pulsed source [1]. This source was developed using a Q-switched Erbium fibre laser. The pulsed output from the fibre laser at 1.53μm generates the required pulse at 1.65μm by a process of stimulated Raman generation. Pulses of 8watts, 10ns with an optical 3db bandwidth of 25nm centered at 1.65μm are produced. These pulses are combined with a novel method of increasing the range of OTDR by using the fibre under test as an additional Raman amplification medium.

An increase in dynamic range of 17.5dB has been demonstrated by amplifying the 1.65μm signal using the 1.53μm pump within the sensing fibre. Raman amplification occurs when the 1.53μm and 1.65μm pulses overlap due to dispersion within the fibre. By delaying the pump pulse with respect to the OTDR pulse, amplification of the later may be delayed by tens of kilometres (Figure 1).

The advantage of this technique arises from the ability to maintain both the pump pulse and OTDR pulse just below the stimulated Raman threshold at the front of the fibre under test. The subsequent amplification of the signal pulse allows greater pulse energy to be achieved some distance down the fibre. Due to the directionality of the Raman gain, amplification is achieved without introduction of any significant noise penalty.

References