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RARE-EARTH-DOPED FIBRE LASERS AND AMPLIFIERS

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Rare-earth doped fibre lasers[1] and amplifiers[2] are attractive for use in fibre optic sensor and fibre optic communication systems since they can be both compact and efficient. With choice of rare-earth dopant the operating wavelength of fibre lasers can be selected in the range 0.55μm[3] to 2.9μm[4], whilst operation of optical amplifiers has been demonstrated around the wavelengths, 0.85[5], 1.3[6], 1.55[2] and 2.7[7]μm.

The flexibility offered by the fibre-host allows the design of new laser configurations. Exploiting these advantages fibre lasers have been developed which operate either cw or pulsed and either narrow band or broadband. The Er^{3+} -doped fibre laser, operating at 1.55μm, is of particular interest for use in communication systems. Erbium lasers have been designed to operate single frequency with a linewidth of <10KHz[8], with a continuous tuning range of 40nm and quantum efficiency >93%. Whilst with an alternative configuration erbium fibre lasers can be made to passively mode-lock, generating pulses as short as 320fs with a corresponding bandwidth of 9nm[9].

The erbium doped fibre amplifier (EDFA) is of enormous interest to the communication industry due to its wavelength of operation, namely 1.55μm. In this case the simplicity of the fibre host is a major advantage. This allows compatibility with the transmission fibre removing troublesome Fresnel reflections. In addition the EDFA offers the advantages of high gain, high efficiency[10], low-noise[11] and potential multichannel operation with low crosstalk[12].

This paper will review the design and performance of both fibre lasers and amplifiers.

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