

Synchronously-pumped Optical Parametric Oscillators

David Hanna

Optoelectronics Research Centre
University of Southampton

Synchronously-pumped Optical Parametric Oscillators (SPOPO) produce an output similar to that of a mode-locked laser, with the further, well-known, advantage of an extremely wide tuning range. Despite the SPOPO's obvious similarities to a laser, it is perhaps more important, when looking for new capabilities from such a device, or when developing the device into a practical source, to have a good appreciation of its differences from a laser. The initial part of this talk will therefore outline the basic features of SPOPOs, emphasising their differences from lasers.

From these differences stem important benefits, of which, illustrative examples will be provided from experimental results. The use of highly nonlinear Quasi-Phase-Matched (QPM) materials is an important ingredient in the results to be quoted. The lower thresholds and higher gains are notable differences from typical mode-locked lasers. The low threshold power has allowed demonstration of a SPOPO pumped by a mode-locked fibre-laser. The much higher gain (up to 10's of dB per pass) has led to many interesting results. These include operation at long idler wavelengths, well beyond the conventionally defined infrared absorption-edge: operation with strong temporal compression, ($\times 20$), of the signal pulses: operation with a feedback path which incorporates an optical fibre: operation with a diffraction grating as a feedback mirror

These and other examples are offered as evidence of the important potential role of SPOPOs within the repertoire of coherent light sources. It will also be argued that a better understanding of the basic characteristics of SPOPOs needs to be developed if their potential is to be fully realised.