Mode-locked fibre lasers with high-energy pulses

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Elongation of the resonator of a mode-locked fibre master oscillator can raise its pulse energy up to several μJ without application of Q-switching or cavity dumping techniques, as well as without additional optical amplifiers [1, 2]. However, increased energy may lead to changes in the pulse shape [3]. It is therefore important to control both pulse duration and pulse energy in various-length cavities of mode-locked fibre lasers that use different methods of mode locking. Recent studies [4–8] have demonstrated such possibilities, and the aim of the present work is to analyse and discuss them. Thus, it has been shown that a considerable elongation of the resonator of a mode-locked fibre master oscillator (up to 25 km) brings both pulse energy and pulse duration close to those of a Q-switched fibre laser with the same pulse repetition rate, although the structure of pulses generated in such a mode-locked laser is markedly different. The laser output in this case consists of nanosecond-long envelopes stochastically filled with femtosecond pulses. Unusual composition of these pulses stimulates active research on physical mechanisms that give rise to such pulses and on their application in different fields.

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