Observation of Unstable Pulse Generation in Yb-fiber Mamyshev Oscillator using Time-stretch Spectroscopy

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Recently, Mamyshev oscillator based on Mamyshev 2R (pulse re-amplification and spectral reshaping) generator [1] with a normal dispersion amplifier and offset filtering, is attracted attention to a method of high-peak intensity pulse generation. Due to high single-pass gain in a normal dispersion region at a wavelength of 1040 nm, Yb fiber has been demonstrated mainly for the high-intensity Mamyshev oscillator [2]. In contrast, to obtain the high average power with broadband spectrum from the Mamyshev oscillator, the high pump LD power requires. When the pump LD power is too high, the operation mode, however, would be switched from the stable pulse, mode-locking (ML) to an unstable state such as a noise-like pulse (NLP). Thereby, to avoid putting into the NLP from ML, the measurement of the shot-to-shot spectrum is necessary to detect the difference between ML and NLP.
Thanks to progress on a time-stretch data acquisition, a single-shot spectrum of ultrafast phenomena can be measured in real-time. The spectral information of an optical pulse is mapped to the temporal waveform of a chirped optical pulse by chromatic dispersion. Therefore, the single-shot spectrum measurement technique can be distinguished the stable single pulse regime and the unstable NLP. To date, by using TS-DFT, several interesting soliton dynamics during the mode-locking have been reported [3].
In this presentation, we report on a shot-to-shot spectrum instability in the Yb fiber Mamyshev oscillator by using time-stretch spectroscopy. Figure 1 indicates consecutive single-shot spectra of laser pulses in the stable and unstable regime. As shown in Fig. 1, the single-shot spectral measurement enables the difference between both operation modes clearly. The detailed dynamics will be discussed in the presentation.

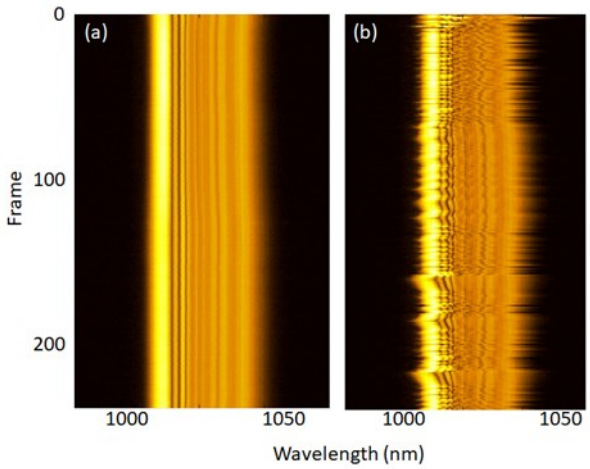

Figure 1. Single-shot spectra of 232 consecutive pulses with TS-DFT showing (a) stable and (b) unstable operation.

References

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