



Generation of dual-wavelength square wave pulse in a passively mode-locked erbium-doped fiber laser

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I. Introduction

In this paper, we report the experimental study of passively mode-locked erbium-doped fiber laser based on nonlinear fiber loop mirror (NOLM). We have obtained the dual-wavelength square pulse output in the region of dissipative soliton resonance (DSR) with the central wavelengths of 1531 nm and 1557 nm, and studied the output characteristics of square wave pulse under different pump power.

II. Experimental Setup

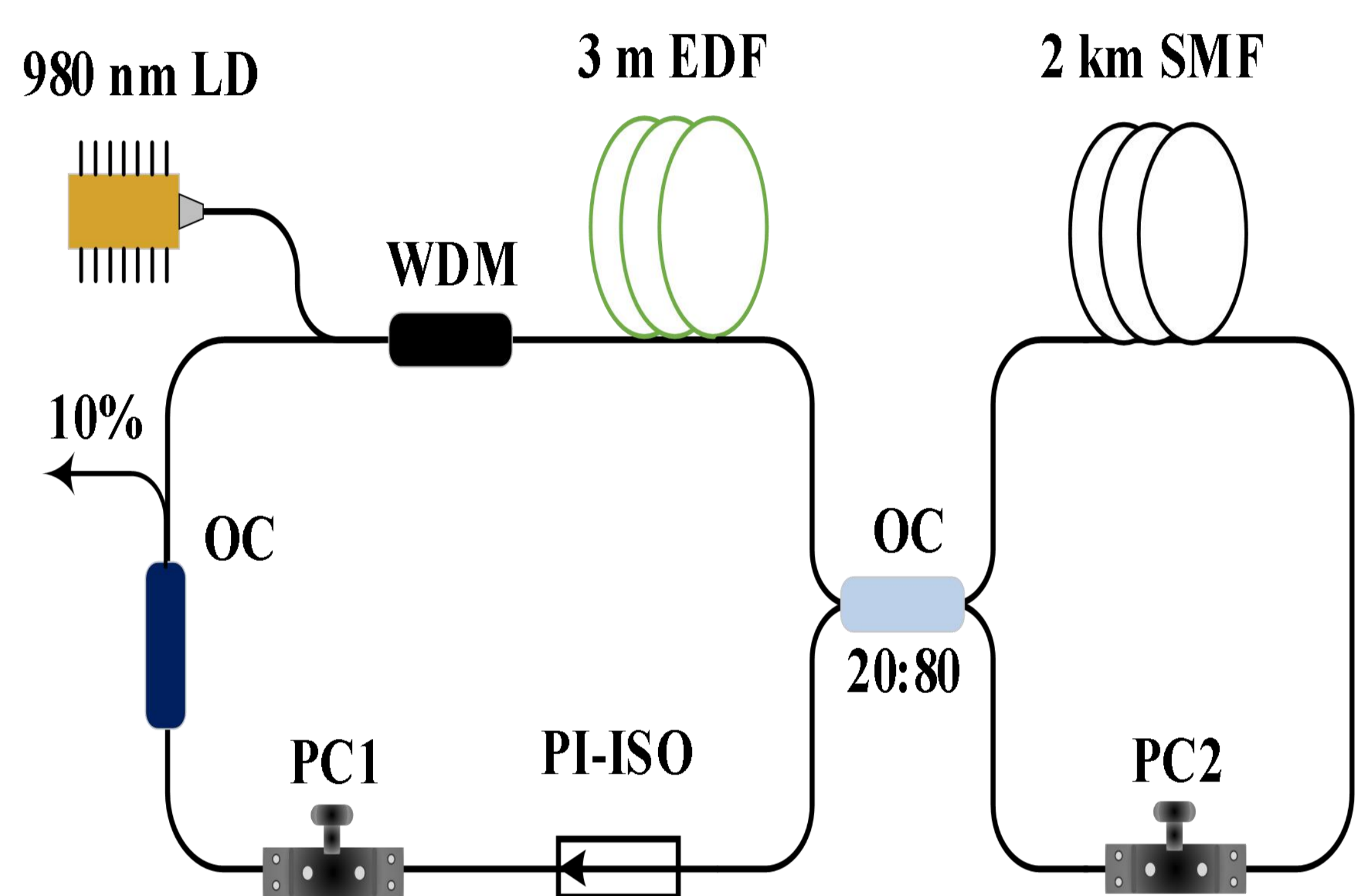


Figure 1. Experimental setup of the figure-eight mode-locked erbium-doped fiber laser based on NOLM. WDM, wavelength division multiplexer; EDF, erbium-doped fiber; SMF, single-mode fiber; PC1(PC2), polarization controller; OC, optical coupler; PI-ISO, polarization-independent isolator; LD, laser diode.

III. Results and Discussion

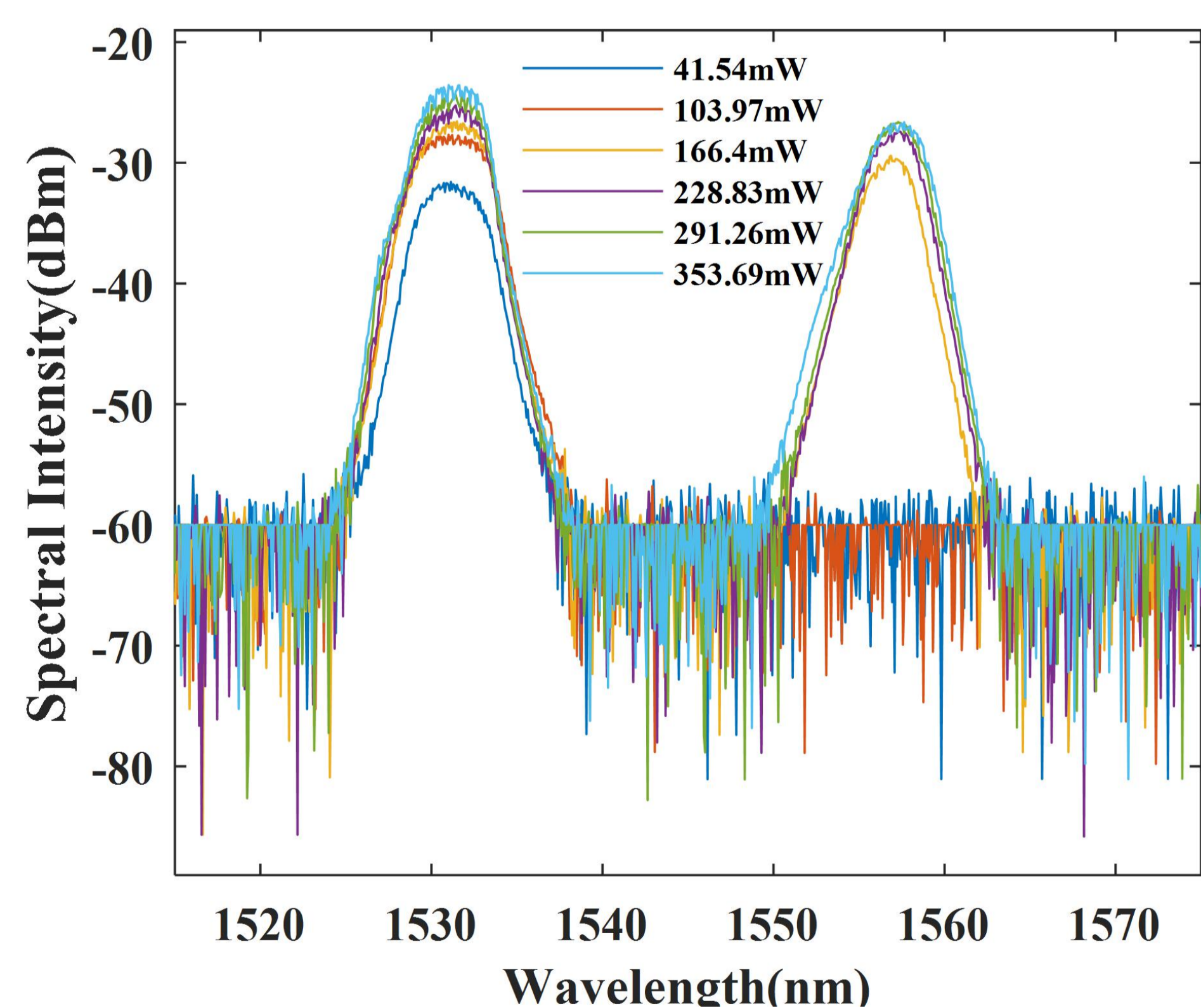


Figure 2. Evolution of optical spectrum with pump power.

The laser emission spectra have two different peaks, and their central wavelengths are located at 1531 nm and 1557 nm respectively.

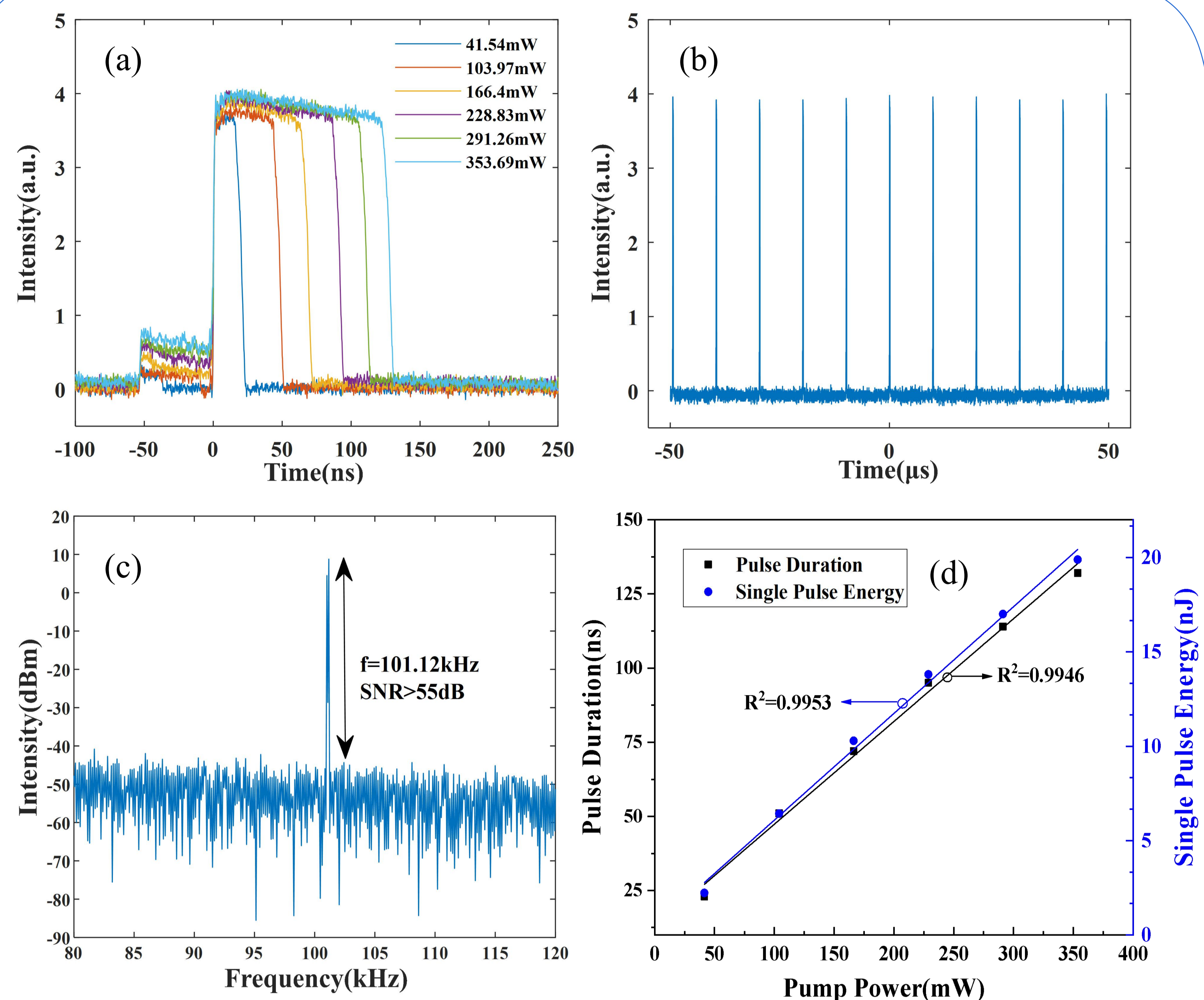


Figure 3. (a) Evolution of pulse profile with pump power. (b) Square wave pulse train under the pump power of 353.69 mW. (c) RF spectrum of square wave pulse under the pump power of 353.69 mW. (d) Square pulse duration and single pulse energy as a function of the launched pump power.

(a) When the pump power increases from 41.54 mW to 353.69 mW, the pulse duration of the output square wave pulse increases from 23 ns to 132 ns, while the amplitude is almost constant.

(b) The pulse interval is about 10 μ s.

(c) The pulse repetition frequency is 101.12 kHz. The signal-to-noise ratio (SNR) is measured to be exceeding 55 dB. This indicates that the square wave pulses are quite stable.

(d) The single pulse energy and pulse duration of the output square wave pulse vary linearly with the increase of the pump power.

IV. Conclusion

1. The experimental study of a passively mode-locked erbium-doped fiber laser based on the NOLM has been demonstrated. The dual-wavelength square wave pulse output in the region of DSR with the central wavelengths of 1531 nm and 1557 nm is realized.
2. The output characteristics of square wave pulse under different pump power are studied.
3. Under the pump power of 353.69 mW, a stable square wave pulse with SNR exceeding 55 dB is obtained. The output average power of the pulse is 2.01 mW and the pulse duration is 132 ns. The maximum single pulse energy reaches 19.88 nJ.

Acknowledgment

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