Theoretical and experimental studies of pulse pumped random fiber laser

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Abstract

Random distributed Raman fiber laser (RRFL) has been widely studied in recent years due to the simple structure and special laser performances [1-3]. It is reported that RRFL has been applied in varied lasers generation, such as multi-wavelength, tunable, cascaded, narrow linewidth, polarized maintained and pulse random fiber lasers[2,3]. Pulse operation is very important due to a wide range of potential applications, such as sources for communication and interrogating fiber optic sensors. Among the pulse RRFL generation schemes, pulsed laser pump is the simplest method, which can also export stable laser output, but the optical efficiency is relatively low in previous result [4]. So, in this paper, we would like to give a thoroughly study on pulse pumped RRFL. An time-depended power balance equations is built to analyze the output performance of the pulsed pump random fiber laser for the first time. The calculated results show that square pulse is more efficient than Gaussian pulse and the shorter pulse width would result in lower optical efficiency (shorter than 100ns for our case). It is found that the output pulse width has a linear relationship with the pump pulse width. When the pump pulse is higher than a certain value, the optical efficiency is nearly independent with the pulse width. The dependence of the lasing threshold and maximum output on fiber length is the same as the CW pump case. All these results are supported by the experiments and it is meaningful to design high efficiency pulse random fiber laser.

Figure 1 is the basic system setup of pulse pumped RRFL, which is a half open cavity. The pump wavelength is 1064nm and pulse width can be tuned from 20ns to 400ns with several watts peak power. Figure 2 is the output results of the experimental and calculated pulse pumped RRFL, it can be found that the calculated results can agree well with the experiments, more detail results would be presented in the conference.

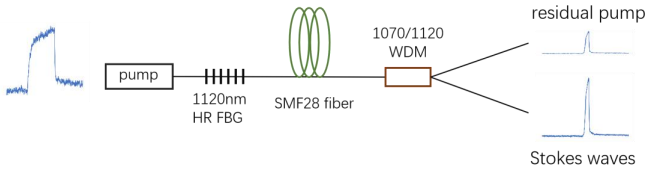

Fig. 1 Schematic structure of pulse pumped random fiber laser

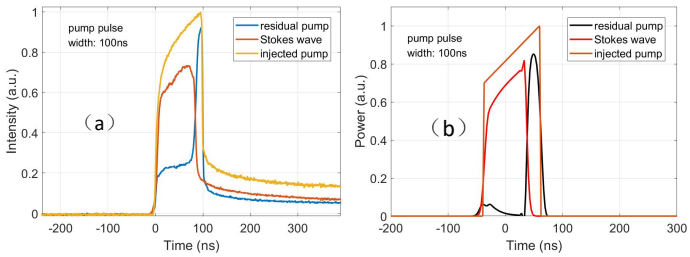

Fig. 2 The (a)experimental and (b) calculated pulse pumped random fiber laser output

References

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