

Design of an erbium-doped fiber ring laser with DWDM-compatible spectrum

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Abstract

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Optical fiber vibration sensing system has the potential to be integrated with the optical fiber communication network, thus providing security monitoring function. To prevent the reduction of the transmission capacity of the communication due to the introduction of sensing system, the laser source of the sensing system has to be compatible with the dense wavelength division multiplexing (DWDM) limitation on the bandwidth.

Erbium-doped fiber ring laser has long been a research focus as laser source. Previous research mainly focused on the single-longitude mode and multi-longitude mode operating conditions with high laser power and narrow bandwidth. However, narrower bandwidth has been proved to bring a higher coherent noise, which decreases the signal-to-noise ratio (SNR).

In order to solve the trade-off between compatibility with DWDM and SNR, in this research an erbium-doped fiber ring laser (EDFRL) operating at C-band is demonstrated. The transition process of non-oscillation to oscillation states in the ring laser is theoretically analyzed and experimentally verified. Output power is simulated and fits well with experiment data. The EDFRL in the research is able to output a maximum laser power of over 0 dBm with step-like spectrum and 3dB bandwidth of more than 0.6 nm. A slight improvement in the SNR is observed when the ring laser is used as laser source in an optical fiber sensing system, with no decrease in the communication quality.

Biography

Yuze Yan received B.S degree from Department of Material Science, Fudan University in 2013. He is now a Master candidate in Department of Material Science, Fudan University. His work is focused on optical fiber sensing system, including optical structure design, fiber ring laser and signal processing.

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