ブリルアン光相関領域リフレクトメトリにおける ブリルアンダイナミックグレーティングの分布測定

Distributed Measurement of Brillouin Dynamic Grating in Brillouin Optical Correlation Domain Reflectometry

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Distributed measurement of Brillouin dynamic grating (BDG) in Brillouin optical correlation domain reflectometry (BOCDR) is proposed. The principle is shown in Fig.1. When strong pump light is injected into the Y polarization of a polarization maintaining fiber (PMF) and generates stimulated Brillouin scattering in Y polarization, the BDG can be shared with the X polarization. In this case, the Stokes power generated by spontaneous Brillouin scattering can be enhanced, under the condition that the frequency offset of X/Y polarization satisfies the BDG equation [1]. The frequency offset is used as the sensing parameter. The experiment setup is shown in Fig.2. The laser is divided into pump, read and reference light. The BDG enhancement is effective along the entire fiber, and the SOCF principle of BOCDR selects the BDG at the position that needs to be observed. The pump light is chopped and the result is recovered using the lock-in scheme [2].

Fig.3 shows the distributed BDG with ordinary lock-in amplifier (LIA) setting. The power of the spectrum is observed to decrease quickly along the optical fiber. The reason is that the pump power depletes fast when SBS is occurring in the fiber, and BDG can only be seen clearly at the beginning of the fiber. In order to observe the BDG near the far end of the fiber with very low power, the sensitivity of LIA is adjusted to different level when measuring each position. The result is shown in Fig.4, where the distribution of the BDG spectrum is observed.

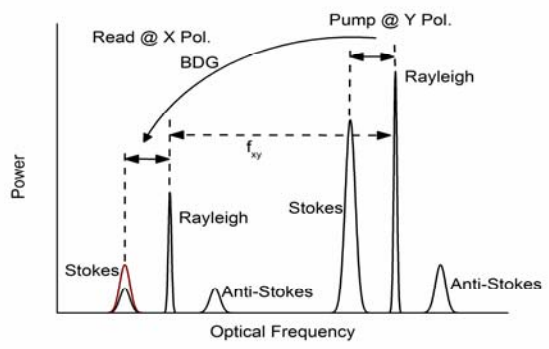

Fig.1. Principle of BDG measurement in BOCDR.

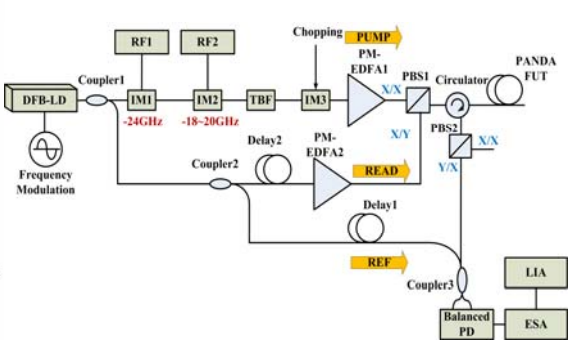

Fig.2. Simplified experimental setup of BDG- BOCDR.

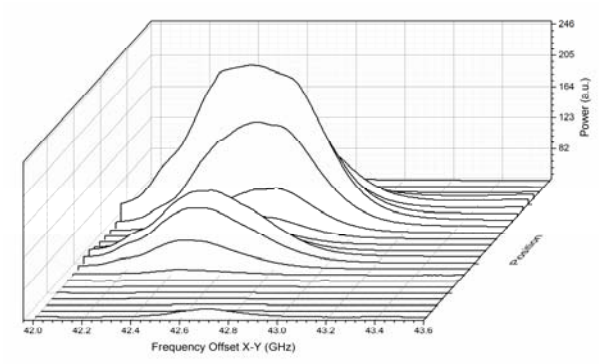

Fig.3. Distributed BDG measured with uniform LIA setting.

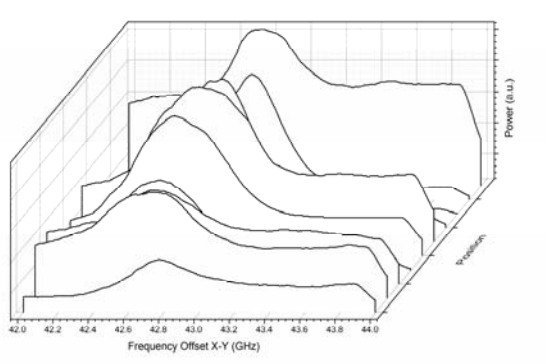

Fig.4. Distributed BDG measured with LIA setting for each position.

Reference

[1] K. Y. Song, W. Zou, Z. He, and K. Hotate, Optics Letters, vol. 33, pp. 926-928, 2008.

[2] Yuguo Yao, Masato Kishi, Kazuo Hotate, APOS, APO15-PO100-161, Jeju Island, Korea, May 20-22, 2015. <invited>