Study on Phase Noise Characteristics of Optical Fiber Sensing System Based on Remotely Pumped Light Amplification

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INTRODUCTION

The interferometric optic fiber sensor can achieve the complex target detection of underwater acoustic signal processing, Marine field, environmental monitoring etc. They also can realize the multiplex. Combined with the existing long-distance optical fiber communication technology, they can effectively achieve the hundreds of kilometers long distance signal transmission. The Marine environment is more complex and diverse than land. So, the long-distance transmission will inevitably introduce greater inherent optical loss, which makes the optical signal returned by sensor array reach the dry end receiver with very low power. It caused the receiving difficulty increases dramatically. Therefore, we build a remotely optically pumped amplifier (ROPA) experimental system by comprehensively utilizing EDFA technology and remotely pumped technology to analyze the signal light gain and phase noise in the transmission process of the optical fiber sensor array remotely pumped.

OBJECTIVES

In this work, We use a method to calculate the full scattering threshold, and compare the theory with the experiment.

METHODS

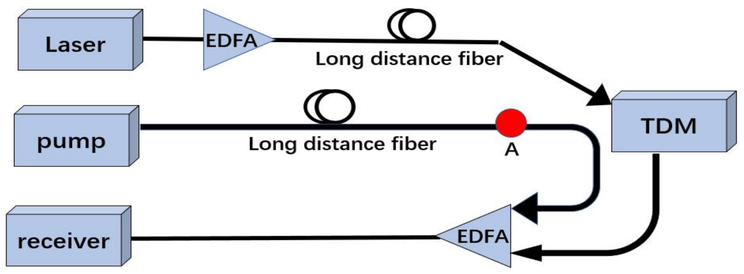

Fig.1 Basic structure of remotely pumped light amplifier

The structure adopts remote optical amplification structure. In order to reduce the phase noise of the sensing system, the fiber optic sensor uses a narrow linewidth laser to pass through an optical pulse generator and an optical power amplifier and then enter the downlink remote transmission fiber and fiber optic sensing Time Division Multiplexing (TDM) array. The 1480nm pump light is transmitted via a separate remote transmission fiber and via a Remote Gain Unit (RGU).

RESULTS

In summary, the pump transmission and RGU gain performance of the remotely pumped optical amplifier in the system are limited by the spontaneous Raman effect Conventional spontaneous Raman theory calculation calculates that the threshold power is about 1W. However, the experimental results of optical amplification of remotely pumped with optical fiber sensing system show that no obvious phase noise will be introduced.

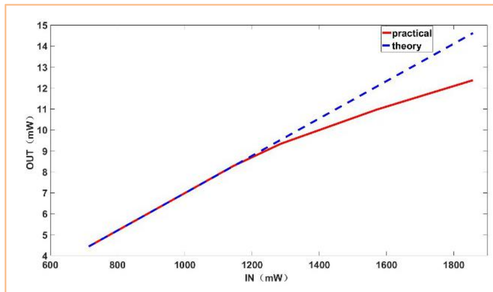

Fig2 Total system losses

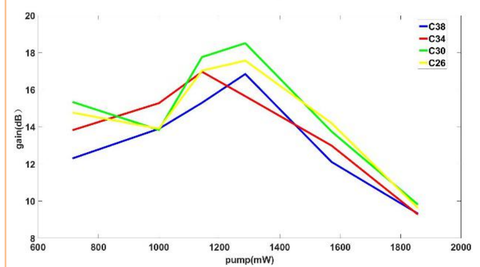

Fig3 Optical gain of each signal

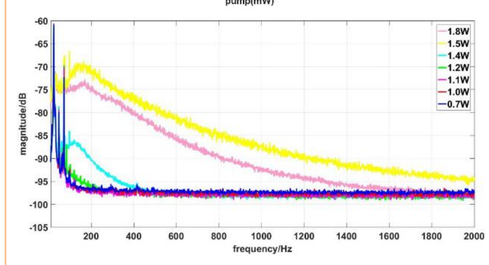

Fig. 4 Phase noise varies with pump power

1.1W is slightly higher than the spontaneous Raman threshold value of 1W which is slightly higher than the spontaneous Raman threshold value of 1W.

CONCLUSIONS

The results show that in the 100km remotely pumped transmission system, the maximum RGU gain is obtained when the tele-pump power is 1.1W, and there is no obvious anomaly in the optical intensity noise and phase noise. As the pump power continues to increase, the spontaneous Raman occurs. And part of the pump light is converted to the 1580nm band, resulting in the decrease of 1480nm signal light and the decrease of RGU gain..