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Bending-Fiber Mode Filter Evaluation for 1060nm Data Transmission in Conventional Single-Mode Fiber

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1. Introduction

In order to meet the upcoming demand for high-speed (>100Gbps) and long-distance (>1km) data transmission, the current mainstream scheme of using 1.3um/1.5um Distributed Feedback (DFB) lasers with G.652 single mode fiber (SMF) limits its further applications in hyper-scale data center and post-5G networks due to its high cost and high energy consumption. Thanks to low threshold, high efficiency and easy manufacturability of VCSELs, optical links using 1.1µm VCSEL and conventional SMF(G.652) will bring significant benefits in cost and energy consumption [1]. A concern is the crosstalk [2] generated in two mode transmission of SMF at 1.1µm. A mode filter could be some help to reduce the crosstalk. In this paper, a bending-fiber mode filter at 1060nm band is modeled and its high order mode rejection ratio is simulated. The simulation results are supported by bending fiber experiments.

2. Modeling and Experiment

The model is schematically shown in Fig.1. To simplify the simulation, we use a square shape with a side length of 30µm. The core is a round shape with 8.2µm diameter in SMF28. The refractive index difference (Δ) is 0.4%. Based on this bending direction, the LP11_b will suffer a bigger bending loss than LP11_a. In order to evaluate the bending mode filter at 1060nm band, we propose to splice 2 fibers with a lateral offset as shown in Fig. 2. The offset amount is controlled for different excitation efficiencies of LP11 mode as shown in Fig. 3. LP11 mode reaches at maximum excitation efficiency of over 35% at an offset of 4µm.

The schematic of experiment set-up is shown in Fig.4. Because the bending loss is dependent on the direction of the two-lobe pattern of LP11 mode, we use a polarization controller to rotate the spatial pattern of LP11 mode [3]. Figure 5 shows the measurement and simulation results of the bending loss of both LP01 and LP11 modes. The blue and orange line represent the simulation result of LP11_a and LP11_b, respectively. While the limited accuracy of our measurement can be seen, the experiment is in agreement with the simulation.

We could also see that the LP01 mode has a negligible insertion loss especially when R>6mm. That means our mode filter could realize high rejection ratio for LP11 mode and negligible insertion loss for LP01 mode.

3. Conclusion

We carried out the modeling and measurement of a LP11 mode filter based on a simple bend fiber. The measurement result is in agreement with the simulation model, exhibiting a possibility of a compact and high-rejection mode filter for use in two mode fiber data transmission at 1060nm band.

4. Acknowledgement

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5. References

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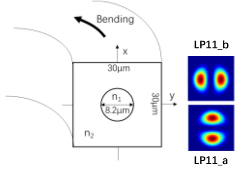

Fig.1 Modeling schematic

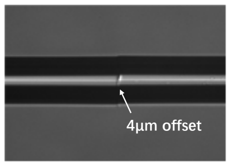

Fig.2 Offset splicing

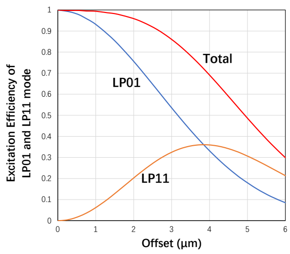

Fig.3 Excitation efficiency of LP01 and LP11 mode as function of offset

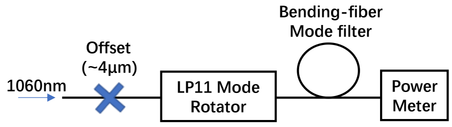

Fig.4 Schematic of experiment set-up

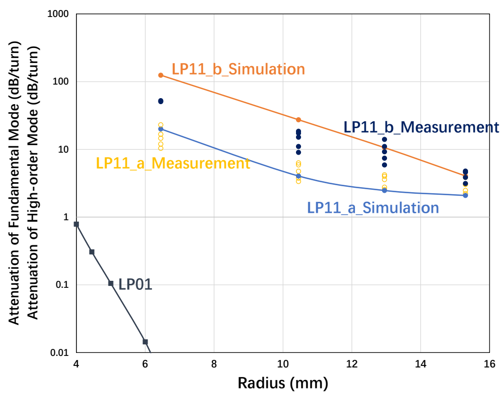

Fig. 5 Bending Loss as function of bending radius