5. Conclusion

We propose and experimentally demonstrate a fully tunable and reconfigurable 8-tap FIR filter using a SM-to-MM fiber combiner. Optical interference from coherent summing and sensitivity from phase fluctuations have traditionally made SSMPF filters less popular than MSMPF filters. However, we introduce the use of a combiner that spatially couples the input signals into a piece of multimode fiber eliminating optical interference. Our architecture only requires a single wavelength narrowband laser source and can be built into existing fiber optic systems. Thus, the major drawbacks of MSMPF, their spectrally inefficiency, complexity, and bulkiness, can be overcome, and we have a filter that combines the advantages of both SSMPFs and MSMPFs. Our architecture is fully reconfigurable and tunable. Optical attenuators with quick response times provide weights, while tunable optical fibers provide delays. Since only a single laser is used, the architecture can be easily scaled merely by adding additional splitters and optical amplifiers up to the limit imposed by the ASE of the optical amplifiers.

An 8-tap filter was experimentally demonstrated. Close agreement between predicted and measured magnitude responses was observed, evidence of accurate matching of tap coefficients and delays. Successful implementation of the SM-to-MM fiber combiner was evident by the excellent stability and low noise was shown by the system. The combiner eliminates interference and phase noise as desired and filter operation is stable and robust.

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