Coherent Regeneration of Optical Frequency Carrier with 1-s instability at 10^{-17}

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Abstract: The remote regeneration of coherent optical frequency technique finds increasing applications in the fields of large-scale optical clock networks, precision spectroscopy, very-long baseline interferometry, and high-sensitivity tests of fundamental physics. Meanwhile, with the improvements of coherent optical frequency generation, the requirement of stable transfer is more and more demanding.

Here, we demonstrate a regeneration system of coherent optical frequency based on bidirectional phase locking, in which the locking loop at the local site is for eliminating optical phase noise over the link, and the locking loop at the remote site is for locking to the incoming coherent optical frequency. Preliminary experiment over a 300 m fiber link indicates that the additional frequency stability can reach 8.7×10^{-17} and 8.8×10^{-18} at an averaging time of 1 s and 100 s, respectively. This method can be further extended to remote optical frequency comparisons for multiple users.

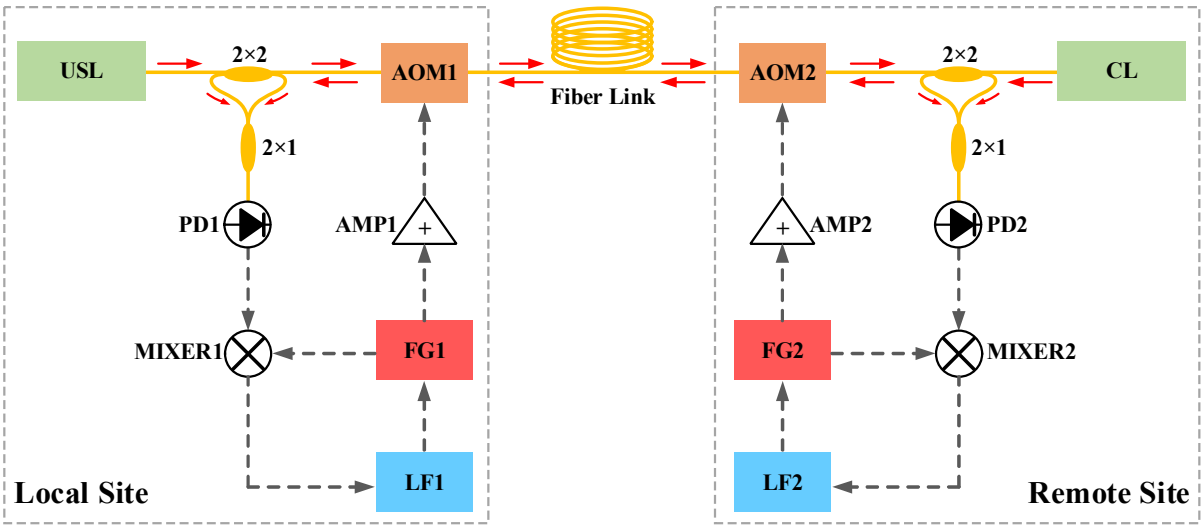

Fig. 1 Principle of regeneration of coherent optical frequency over fiber link. USL: ultra-stable laser, PD: photodetector, AOM: Acousto-optic modulator, AMP: amplifier, FG: function generator, LF: loop filter, CL: coherent laser.

References

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