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Fiber-based Two-wavelength Heterodyne Laser Interferometer YANQI ZHANG, Texas AM University, University of Arizona, KI-NAM JOO, Chosun University, FELIPE GUZMAN, Texas AM University — Precision displacement laser interferometry is crucial in gravitational wave observatories, for instance, in the direct measurement of the test mass dynamics, and for ancillary instrumentation regarding the low-noise operation of the observatories. We are currently developing a fiber-based heterodyne laser interferometer that features compact size and low noise floor. Two wavelengths are utilized to construct a reference and a measurement interferometer with only one optical setup. The highly common optical paths between the two interferometers provide a high common-mode rejection ratio to typical noise sources. In this paper, the interferometer design will be stated, along with a mathematical model describing noise effects expected from various fiber components in the system. A benchtop prototype has already shown sub-nanometer-level displacement sensitivities in air at frequencies above 100 mHz in our lab. We will present the progress and measurement results on the performance of the proposed interferometer, including initial results in vacuum.

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