Absolute distance measurement by dispersive interferometry using a femtosecond pulse laser

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Abstract: We describe an interferometric method that enables to measure the optical path delay between two consecutive femtosecond laser pulses by way of dispersive interferometry. This method allows a femtosecond laser to be utilized as a source of performing absolute distance measurements to unprecedented precision over extensive ranges. Our test result demonstrates a non-ambiguity range of ~1.46 mm with a resolution of 7 nm over a maximum distance reaching ~0.89 m.

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References and links

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1. Introduction

The advent of femtosecond ultrashort pulse lasers has prompted various efforts to investigate new possibilities of advanced optical interferometry that were not possible with traditional sources such as CW lasers and white light. A notable example is the exploitation of a femtosecond laser for optical coherence tomography with the aim of performing high resolution biomedical imaging by way of either low-coherence interferometry [1] or complex spectral signal processing [2]. Another is the significant extension of the measurable distance of no periodic ambiguity by means of synthetic wavelength interferometry utilizing a femtosecond laser, which was carried out in the radio-frequency domain using a sequence of higher harmonics of the repetition rate [3] or in the optical frequency domain with flexible

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