Two-dimensional Spectral Shearing Interferometry for Ultrafast Pulse Characterization
Technology #12015

Applications

- Ultrafast pulse characterization

Problem Addressed

SPIDER, spectral phase interferometry for direct electric-field reconstruction, is a method for determining the phase of few- and single-cycle optical pulses. The method is based in the frequency domain and uses spectral shearing interferometry to calculate phases. However, there are several design problems with the SPIDER system. First, SPIDER has a built-in delay between pulse copies which must be calibrated and maintained to beyond the precision available in most interferometers. Since there always is a pulse width error, the delay must be known to within attosecond pulse accuracy in order to ensure even 10% accuracy. This is very difficult with given technological constraints. Also, for optimizing a system, such as a laser, the pulse accuracy must be recalibrated during optimization to avoid underestimation of the pulse width. In addition, using common pulse amplification methods, such as chirped pulse amplification, may inhibit the optimization of important characterization parameters, such as shear and delay.

Technology

The invention is a two-dimensional spectral shearing interferometry system which is capable of extremely accurate measurements over a large bandwidth. In addition, it is optically simple and reduces the need for recalibration. By encoding phase along a separate dimension, the invention eliminates dispersion in the measured pulse, reduces delay between sheared pulses and relaxes the spectrometer resolution. This allows for complex phase spectra to be measured over extremely large bandwidths, greatly reducing the demands on the spectrometer. In addition, multiple shears can be used on a given pulse as a self-consistent verification that no spurious absolute phase errors have occurred. This method achieves the identical pulse width predictions to within a few hundredths of a femtosecond for shears ranging from 4 THz to 20 THz.

Advantages

- Optically simple
- Minimal calibration required
- Extremely accurate measurements
- Large bandwidth

Categories For This Invention:

Photonics
Other (Photonics)
Intellectual Property:
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External Links:
Ultrafast Optics And X-Rays
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