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A General Noise Suppression Scheme With A Reference Beam In Optical Heterodyne Spectroscopy

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BRIEF DESCRIPTION

A methodology to suppress additive and convolved noise in optical heterodyne signals

FULL DESCRIPTION

Often, the signal strength in optical spectroscopic techniques is weak and requires signal amplification. One such method of amplification mixes an oscillating optical signal with the weak signal. However, this amplification method is susceptible to noise artifacts caused by intensity fluctuations of the oscillating optical signal. Current optical intensity noise reduction solutions do not effectively address the noise artifacts by using expensive and often ill-suited matched detectors for reference. Researchers at the University of California have developed low cost method to improve the signal to noise ratio by dynamically subtracting such intensity fluctuations detected with a reference detector.

The proposed invention suppresses additive and convolved noise in the optical heterodyne signals through reference beam detection and digital based subtraction. The intensity fluctuation of the oscillating optical signal is directly monitored prior to mixing with the weak signal to be digitally subtracted out of the combined detected signal. Noise suppression can be applied in real time to adjust for the changes in intensity of the optical oscillating signal improving signal noise down to the thermal noise floor of the detector. By increasing the signal to noise ratio of optical spectroscopic systems one can realize more information from weak signals detected.

SUGGESTED USES

- » Suppressing the noise of amplified weak signals detected in non-linear and linear spectroscopic techniques.
- » Including but not limited to suppressing noise found in pump-probe non-linear Coherent Anti-Stokes Raman Spectroscopy(CARS), and Optical Coherence Tomography(OCT)

ADVANTAGES

- » Higher signal to noise ratio for optical heterodyne spectroscopy
- » Low cost solution and better noise reduction than previous matched detector methodology
- » Maintains signal phase information
- » Real-time adjustment of noise suppression scheme

PATENT STATUS

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OTHER INFORMATION

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STATE OF DEVELOPMENT

Methods of the noise reduction technique have been proposed, and methods to implement the proposed invention have be developed.

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