Distortion free-phase demodulation method

INVENTORS: Claudio Oton
Philippe Velha
Ysbel Marin

STATUS PATENT: Granted

PRIORITY N° : 102020000019267

PRIORITY DATE: 05/08/2020

PUBLISHED AS: IT

Invention

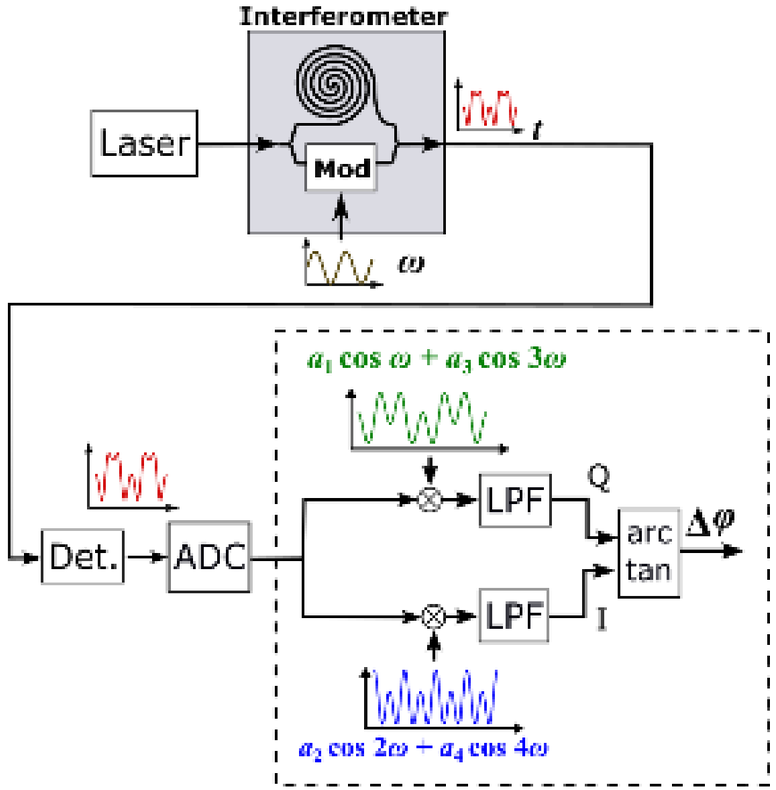
Optical interferometry is currently the most accurate technique to measure certain physical magnitudes such as displacement, vibrations, wavelength, among others. However, extraction of the phase may be subject to distortions and noise. We propose a simple method which removes phase distorsions without increasing noise, and can be implemented in any interferometer with active phase control (fiber-optic, integrated, free-space).

The method is based on a Phase-Generated-Carrier demodulation scheme. It consists of mixing the measured trace with linear combinations of odd and even harmonics of the signal, so that the dependence of the distortion on modulation depth cancels out in its first and/or second derivatives. Technical details with proof-of-concept experimental results are published in a scientific journal [Y. Marin et al, “Distortion-corrected phase demodulation using phase-generated carrier with multitone mixing” Optics Express, 28(24), p.36849 (2020)].

The main advantages of this invention are:

- Simple to apply (only requires two mixers)
- Do not increase the noise in any quadrant
- Do not require periodic calibrations
- Instantaneous (does not use data from the past).

Drawings
& pictures



Industrial Applicability

Applications include all situations where optical interferometers are used:

- Wavelength meters
- Fiber-Bragg grating interrogators
- Interferometric optical fiber sensors
- Laser vibrometers
- Laser displacement sensors
- Distributed acoustic sensing fiber-optic sensors.

Possible developments

The demodulation technique has been demonstated in the lab (current TRL 3-4). The research group is currently implementing this demodulation scheme in a real-time FPGA system, which will be part of a prototype in the second quarter of 2021, which will take the TRL level to 5-6.

The inventor and the asignee (Scuola Superiore Sant’Anna) are looking for industrial partners for the industrial exploitation of the invention. The inventor will be able to provide prototype versions for testing in specific applications.

For more information:

Tech Transfer Office of Scuola Superiore Sant'Anna

Headquarters: Piazza Martiri della Libertà 33, 56127, Pisa

Web site: https://www.santannapisa.it/it

E-mail: uvr@santannapisa.it

For more information:

Ufficio Regionale di Trasferimento Tecnologico

Headquarters: Via Luigi Carlo Farini, 8 50121 Firenze (FI)

E-mail: urtt@regione.toscana.it