



Optical Phase Shift Solution: Compact and Easy to Install

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a tunable, wide-aperture optical phase shifter that is compatible with current imaging tools and inexpensive to manufacture.

This technology can be used in laser side band generation and in advanced imaging systems including phase-contrast microscopy and optical coherence tomography.

Overview

Optical phase tuning is highly desired in many precision and imaging tools used by industry, in medicine and in biological research. Various optical phase shifters (OPS) and methods exist, each with certain drawbacks. For example, fiber optic-based modulators suffer light loss, liquid crystal phase shifters are slow, and mirror-based systems require complex mechanical controls.

An improved OPS solution is needed to simplify and miniaturize optical systems.

The Invention

UW–Madison researchers have developed an innovative OPS that delivers tunable optical phase shifting with a wide aperture. Unlike many electro-optic modulators, its liquid-based design makes it a versatile candidate for many imaging devices.

The shifter consists of two immiscible liquid layers with different refractive indices. Between the two liquids is a rigid membrane that moves freely along the optical axis. When pressure alters the thicknesses of the liquid layers, it induces an optical path difference, resulting in a phase shift.

Applications

- Optics instrumentation and imaging systems
 - Phase-contrast microscopy
 - Optical coherence tomography
 - Laser side band generation

Key Benefits

- Easily adjusts the optical phase of light propagating through a sample with a desired path length
- Compact and easy to install
- Compatible with current imaging tools
- Inexpensive to manufacture

Stage of Development

A prototype has been developed and can achieve a maximum phase shift of 180 degrees (the threshold for phase shift devices).

Additional Information

For More Information About the Inventors

- [Hongrui Jiang](#)

Related Technologies

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Publications

- [Ashtiani A. O and Jiang H. 2017. A Liquid Optical Phase Shifter with an Embedded Electrowetting Actuator. JMEMS PP 99, 1-3.](#)

Tech Fields

- [Analytical Instrumentation, Methods & Materials : Optics](#)
- [Analytical Instrumentation, Methods & Materials : Sensors](#)

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