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On-Chip Polarization Detection and Polarimetric Imaging

Background

Recent innovations have allowed us to manipulate light for uses in a variety of applications such as information processing and quantum computing. More specifically, polarization of light has become an attractive method for communicating optical data, demonstrating better sensitivity, signal in free space, and capacity than conventional communication approaches. However, manipulation and detection of light is difficult to analyze using one single material or device. Currently, multiple bulky optical components such as polarizers, waveplates and mechanically rotating parts are used to convert polarized optical signals. These methods for capturing polarized light are slow, extremely expensive, and occupy a great deal of space. This combination of factors greatly decreases the potential of the technology. Therefore, there is a need for a compact, cost-effective device to quickly convert light between various polarization states.

Invention Description

Researchers at Arizona State University have developed a device capable of handling and characterizing the polarization state of optical signals in a compact form factor. Breakthroughs in research have led researchers to provide an ultrathin, on-chip integrated polarization sensing device. Elements in the device extract the polarization state of light by using a super pixel. Polarization-sensing super-pixels are capable of picking up different orientations and frequencies of light polarization states using nano-sized gratings as filters. Furthermore, polarization sensors within the device do not require complicated 3D fabrication or stacking of many layers. This results in inexpensive methods for fabrication compatible with high-volume production, and compatibility across a broad range of devices.

Potential Applications

- Optical Communication
- Quantum-Based Optical Computing
- Information Processing
- Biomedical Imaging
- Multispectral Imaging

Benefits and Advantages

- Innovative – Replaces large, expensive, and slow analytical tools with an efficient on-chip detection device
- Efficient – A small-scale integrated device capable of response times on the order of milliseconds
- Versatile – Equipped with a variety of polarization sensors to extract and detect different polarization states
- Simple – A powerful and simple architecture allows for inexpensive production and compatibility

Professor Yao's Website