University of Central Florida

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Electronic Optical Phase Modulation

UCF researchers have shown that optical phase conjugation can be implemented in the optoelectronic domain using coherent detection and electro-optic conjugation of the optical pump.

It is possible, using nonlinear optical processes, to exactly reverse the propagation direction and phase variation of a beam of light. Optical phase conjugation (OPC) can be used for many applications ranging from laser medicine to imaging to communications.

Advantages

Until now, purely optical techniques have been used to realize OPC, however, this classical approach is limited by its inability to quickly and precisely adapt the phase conjugation. Using electronic optical phase modulation, optical transmission through complex media such as biological tissue, traditionally limited by multiple light scattering, can now be realized. In laser medicine, this technique can fluorescently label a cell (e.g. cancer cell) and use the advantages of OPC to selectively interact with these cells without effect to surrounding tissues. These actions can be thermal, mechanical or chemical, all mediated by the back propagated optical beam. This process can also be applied to defense applications where the light/electromagnetic waves come from objects of interest. Using this method, it is possible to use OPC to illuminate/interfere/ or destroy the object that was illuminated.

Technical Details

This process combines electronic and optical phase conjugation. Typically there is an efficiency limitation due to phase conjugation relying on nonlinear optical processes. However, this is resolved by introducing electronic phase conjugation (E-OPC) as a complementary method. OPC defines a special relationship between two coherent optical beams propagating in opposite directions with reversed wavefronts and identical transverse amplitude distributions. The two-step process of E-OPC begins by measuring the wavefront of the signal wave (fluorescence) using a reference beam and charge-coupled device (CCD) arrays so that both quadratures of the wavefront are measured. The measured wavefront is then conjugated in the electrical domain and applied to a spatial modulator array that generates the phase modulated beam to back propagate to the sample. E-OPC removes the wavelength and efficiency limitation as CCD's respond over a broad spectrum, and provides the unique ability to remove aberrations due to a turbid medium.

UCF Inventors

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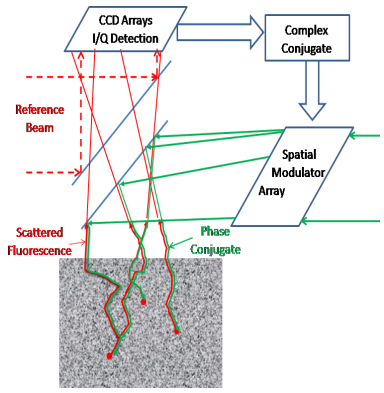

Benefits

- Functions through turbid matter
- Real-time conjugation of complex media
- Higher Efficiency

Applications

- Laser medicine
- Optical defense
- Imaging
- Communications

Tech Fields

Defense, Diagnostics, Optics and Lasers, Communication

Keywords

optical phase conjugation, electronic phase conjugation, nonlinear wave-mixing, charge-coupled device, optoelectronic

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If you or your company are interested in this opportunity, Contact:

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