UNIVERSITY OF BIRMINGHAM

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Electro Optical Infra-red Shutter

Using electro-optical modulation to efficiently and quickly control light in thermal imaging devices instead of mechanical shutters.

Please note, header image courtesy of NASA JPL-Caltech

IP Status

Patent application submitted

Seeking

Development partner, Commercial partner, Licensing, University spin out

About **University of Birmingham**

At the University of Birmingham our research leads to new inventions and fuels innovation and business growth.

Background

The vast majority of thermal imaging devices use a mechanical shutter in front of sensitive elements. The shutter periodically blocks incoming signals to correct the response of the elements with respect to the background. Despite an apparent simplicity of the mechanical shutter, its construction is based on moving parts, which restricts applications of thermal imaging for high-speed measurements and in environments with high g-forces. The mechanical shutter is relatively bulky as it requires a space to accommodate the blade, energy inefficient and inherently limited to slow speed of the modulation.

Tech Overview

Electro-optical modulation is an attractive alternative as it simplifies operation, provides significantly higher modulation speed, shrinks dimensions, is resistant to mechanical shocks and is silent.

Further Details:

Solid-state modulators/shutters based on the electro-refractive effect have been proposed and researched to replace the mechanical counterpart. In the heart of our modulator is a technology based on the fusion of micro- and nano-patterned surfaces with the electro-refractive effect. This technology produces a semiconductor optical structure fully transparent for the middle and far infrared radiation in a passive state. Pumping optically the free charge carriers into the structure activates the modulator. At a specific charge density the structure will almost completely block the incoming radiation. Periodically driven excitation of the structure modulates a passing through signal synchronised with the external driver. The speed of the modulation can reach GHz regime with the modulation contrast above 90%. Moreover the modulation occurs over a narrow band around a specific resonance infrared frequency given by the properties of the structure.

Benefits

- Smaller, faster and quieter than current mechanical shutters
- Provides control over available shutter speeds with the theoretical limit in GHz frequencies regime
- Operable over selected relatively narrow frequency bands
- Allows stroboscopic and 3D measurements
- Provides capability for high-frequency sampling rate needed to improve image quality and the signal- to-noise ratio
- Exhibits robust manufacturing technology
- Extends capabilities of IR and thermal imaging to new markets and applications, such as gaming and position tracking
- Allows IR camera systems to operate without interference from laser-induced dazzle effects

Applications

- Infrared camera systems
- Discriminative imaging systems (hyperspectral imaging)
- Automotive 3D sensor systems
- Telecommunications

Opportunity

These novel silicon structures are being manufactured and tested in a laboratory setting to evaluate performance in the far IR range. The University of Birmingham is seeking either a commercial partner willing to jointly develop this technology for a specific application under a licence agreement, or to fund a spin out company to develop the technology as a platform for use in a variety of markets.

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Patents

- Initial filing GB1221521.6 29, November 2012.
- Patent applications filed in Europe (published as EP137898.0), USA and Israel based on PCT GB 2013/052954