Interferometric Modulator Displays (iMoD™): MEMS-Based Technology Inspired by Nature

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Coloration in nature is generally realized in two ways, through pigmentation or by means of controlling the flow of photons in thin optical films or/and 3D structures.[1,2] Iridescence (originated from the Greek word "irides" – "rainbows") is an optical phenomenon caused by multiple reflections from multiple layers of optical films in which phase shift and interference of the reflections modulates the incident light by amplifying or attenuating certain wavelength more than others. This process is also utilized as selective wavelength attenuation in Fabry-Pérot interferometers.

Recent developments in micro- and nano-fabrication and photonics allow one to fabricate structures that can mimic iridescence in nature by manipulating light in a controlled manner in MEMS/NEMS architectures, thus opening up a window for a variety of novel devices and applications. The QUALCOMM iMoD™ reflective display is a high speed, electrostatically actuated, bistable MEMS device built on a transparent (e.g. glass) substrate.[2-5] An iMoD element consists of a suspended conductive membrane serving as a mirror, over a partially reflective optical stack. There is a few hundred nanometers wide gap between the two that is filled with air. Interference between light reflected from the mirror and from the partially reflective optical stack generates vibrant color. Black is perceived when the iMoD element is in a collapsed state. RGB pixels have iMoD elements with different air gaps designed to reflect in the red, green, and blue wavelength, respectively.

Compared to existing display technologies, the iMoD™ can provide significant advances in viewability, ruggedness, and power reduction. Compatibility with large area LCD manufacturing offers the hope that a favorable value proposition can be achieved and device size will not be a limitation. The device's temperature performance, daylight viewability, and low power modes are the key benefits attractive for a wide variety of consumer electronics applications.

This paper will review the physics and basic fabrication principles of the iMoD™ devices, as well as the current status of the iMoD™ technology for large scale manufacturing. Opportunities for more basic research in the area will also be discussed.

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