Spatial Light Modulators And Applications Spatial Light Modulators For Applications In Coherent Communication Adaptive Optics And Maskless Lithography

Liquid Crystal on Silicon (LCoS) has become one of the most widespread technologies for spatial light modulation in optics and photonics applications. These reflective microdisplays are composed of a high-performance silicon complementary metal oxide semiconductor (CMOS) backplane, which controls the light-modulating properties of the liquid crystal layer. State-of-the-art LCoS microdisplays may exhibit a very small pixel pitch (below 4 ?m), a very large number of pixels (resolutions larger than 4K), and high fill factors (larger than 90%). They modulate illumination sources covering the UV, visible, and far IR. LCoS are used not only as displays but also as polarization, amplitude, and phase-only spatial light modulators, where they achieve full phase modulation. Due to their excellent modulating properties and high degree of flexibility, they are found in all sorts of spatial light modulation applications, such as in LCOS-based display systems for augmented and virtual reality, true holographic displays, digital holography, diffractive optical elements, superresolution optical systems, beam-steering devices, holographic optical traps, and quantum optical computing. In order to fulfil the requirements in this extensive range of applications, specific models and characterization techniques are proposed. These devices may exhibit a number of degradation effects such as interpixel cross-talk and fringing field, and time flicker, which may also depend on the analog or digital backplane of the corresponding LCoS device. The use of appropriate characterization and compensation techniques is then necessary.

Optical MEMS (micro-electro-mechanical systems) devices have been used in a variety of applications including fiber-optic communications, projection TVs and in biomedical imaging. MEMS-based spatial light modulators (SLM) provide a compact, large scale, and cost-effective solution to these and other applications. In this dissertation, we introduce the design and fabrication of SLMs for three such applications.

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Partial Contents: SLM Technologies; Ferroelectric Liquid Crystals SLMs; Smart Pixel SLMs; Poster Session; International Perspective on Liquid Crystal SLMs; Silicon-Addressed Hybrid SLMs; Joint Optical Computing/Photonics in Switching/Spatial Light Modulators Plenary Session; Multiple-Quantum Well SLM Technology; Asymmetric Fabry-Perot MQW Modulators; Optical Interconnects and other SLM Applications; New Materials.

A field as diverse as optoelectronics needs a reference that is equally versatile. From basic physics and light sources to devices and state-of-the-art applications, the Handbook of Optoelectronics provides comprehensive, self-contained coverage of fundamental concepts and practical applications across the entire spectrum of disciplines encompassed by optoelectronics. The handbook unifies a broad array of current research areas with a forward-looking focus on systems and applications. Beginning with an introduction to the relevant principles of physics, materials science, engineering, and optics, the book explores the details of optoelectronic devices and techniques including semiconductor lasers, optical detectors and receivers, optical fiber devices, modulators, amplifiers, integrated optics, LEDs, and engineered optical materials. Applications and systems then become the focus, with sections devoted to industrial, medical, and commercial applications, communications, imaging and displays, sensing and data processing, spectroscopic analysis, the art of practical optoelectronics, and future prospects. This extensive resource comprises the efforts of more than 70 world-renowned experts from leading industrial and academic institutions around the world and includes many references to contemporary works. Whether used as a field reference, as a research tool, or as a broad and self-contained introduction to the field, the Handbook of Optoelectronics places everything you need in a unified, conveniently organized format.

Contents: Liquid Crystal Devices: 1, Liquid Crystal Devices: 2, Photorefractive Devices, Electro-Optical Devices, Invited Speaker Session, III-V Devices, Deformable Structures, Opto-Electronic Devices, Liquid Crystal Devices: 3, Poster Session, Applications: 1, and Applications: 2. (RH).

This work offers comprehensive coverage of all aspects of spatial light modulators, from the various optical materials used for modulation, through the availability and characteristics of specific devices, to the main applications of SLMs and related systems. The gamut of SLMs is surveyed, including multiple-quantum-well, acousto-optical, magneto-optical, deformable-membrane, ferroelectric-liquid-crystal and smart-pixel modulators.

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High-resolution, high-speed, spatial light modulators that offer excellent spatial uniformity are the key devices impeding progress in the areas of optical information processing and computing. The thrust of the MIT research effort is in the area of materials, devices and systems for optical information processing. Our research is focused on 1) The growth, processing and characterization of optical crystals for spatial light modulation, 2) Spatial light modulator prototype device development and 3) Applications of spatial light modulators in symbolic optical processors. This final report describes the purchase assembly and operation of a RF sputtering system that is supporting a number of these and other DOD sponsored research programs at MIT. (RH).