GUEST EDITORIAL

MOEMS: DESIGN, TECHNOLOGY, AND APPLICATIONS

This JM^3 special section on MOEMS entertains readers with excellent papers, containing outstanding new results in R&D, and reports innovative devices in photonics systems, which demonstrate the power of merging micro-optics with MEMS.

Micro-optoelectromechanical systems (MOEMS) includes two major revolutionary technologies: micro-optics and microelectromechanical systems (MEMS). Recent demands for development of crucial components for telecom, wireless systems, lightwave communications, optical interconnects, and satellite communication led researchers to pay more attention to the potential of combining micro-optics with MEMS to create MOEMS, a technology solution to all complex and current unsolved optical problems.

The field of micro-optics has grown into an important technology in the past two decades. The development of a wide range of fabrication technologies, including binary optics and gray-scale photolithography, low-cost replication techniques, and advanced diffractive optics design methodologies, has improved the precision, reliability, and quality of micro-optic components and has broadened the variety of micro-optic devices that can be designed and fabricated.

The field of MEMS has also advanced independent of micro-optics and demonstrated applications in many diverse areas, including machine tools, robotics, inertial microsensors, microvalves, micromachined rf switches, global positioning system component miniaturization, and a host of other sensors and actuators for use in space, air, land, and sea vehicles, as well as industrial, biotechnology, and future consumer electronics.

Combining these two powerful fields of micro-optics and MEMS makes MOEMS an ideal technology for many industrial demonstrations of commercial devices. MOEMS manufacturers and commercial entities are rapidly bringing to demonstration major telecom components such as switches, filters, splitters, interferometers, dense wavelength-division multiplexing, optical routers, beam shaping elements, and variable optical attenuators. Other demonstrations of MOEMS developers are display applications such as deformable membrane devices, grating light valves, digital projectors, head-mounted displays, optical scanners, and adaptive optics components such as deformable micromirrors and telescopic microlens arrays.

MOEMS components are compact, low weight, and can be fabricated at low cost using batch processes; they can also provide unique functions or even a multiplicity of functions, which are difficult or even impossible to achieve with conventional bulk optical processing. MOEMS is an enabling technology for applications that cannot be addressed using micro-optics alone and is currently playing a significant role in numerous optical applications. The trend toward miniaturization and integration of conventional optical systems will accelerate the adoption of MOEMS technology in commercialization of many industrial components, which are today's most desirable elements of optical communication.

As we move through the first decade of the 21st century, we recognize an exceptional growth in the fields of MOEMS. It was the goal of this special section of JM^3 to provide papers in new developments of MOEMS technologies from the basic research to the commercialization stages including design and applications. One of the unique features of this special section is the strong contribution of industrial and international authors. A portion of the papers in this special section are based on works that have been developed in recognized centers along with quality presentations from various conferences. The rest of the papers in this special section were accepted from submission from the MOEMS technical community. From 17 accepted MOEMS papers, 1 paper did not complete the review process in time, and it will be published in the next issue of the journal. This issue has 16 papers—there are 4 papers in fiber optics and telecom, 3 papers in display and spectroscopy, 4 papers in micromirrors and adaptive optics, 3 papers in microlithography and processing, and 2 papers in industrial device packaging.

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Guest Editor