Controllable Mirror Devices

Controllable mirror optics is a new technology for putting light to work in high speed processing of visual information. An alternative to traditional combinations of lenses and other light transmission devices as a means of processing information encoded by light, the technology involves the use of electronically "deformable" (moveable) micro-mirrors for controlling light on a microscopic scale.

NASA scientist Dr. Richard Juday and his Johnson Space Center research team are working closely with scientists and engineers of Texas Instruments, Inc. (TI), Dallas, Texas on a new family of components known as Deformable Mirror Devices (DMD). A DMD is a type of spatial light modulator (SLM) in which mirrors fabricated monolithically on a silicon chip are deformed, or tilted, under electronic control to modulate, or change the direction of, light that falls upon the mirror.

The SLM modulates light in one or more dimensions. In the TI work cosponsored by NASA and the U.S. Army Missile Command, two-dimensional SLMs are being used to modulate all the rows and columns of a digital image in parallel, rather than in conventional row-by-row fashion. This greatly accelerates certain types of image processing and opens up a new range of space, military and civil use applications.

Texas Instruments Peripheral Products Division, Temple, Texas has started commercialization of the technology with a one-dimensional DMD that selectively steers a line of light in a new high speed printing process. The initial application is the DMD 2000™ Travel Information Printer (**in photo**) for high speed, high volume printing of airline tickets/boarding passes (ATBs).

In the DMD 2000, the DMD chip with 840 tiny moveable mirrors is controlled

to selectively reflect light onto a photoconductor drum, which subsequently transfers the image produced on the drum to paper. The TI system can image 1.2 million black dots in one second. The result, says TI, is that "images and text can be integrated on ATB tickets with the quality and speed of xerographic printing and the reliability of a semiconductor chip."

Applications of the two-dimensional DMD being explored by NASA and TI range from real-time object tracking to new ways to achieve autonomous spacecraft landings on other planets, where communications travel time is so great that the spacecraft must operate on its own without the command or informational signals from Earth. Among applications being developed by the JSC team is a hybrid machine vision system that can support autonomous spacecraft rendezvous and docking. The DMD technology also offers promise for advanced industrial machine vision systems. ●

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