Objective Lens Optimized for Wavefront Delivery, Pupil Imaging, and Pupil Ghosting

Goddard Space Flight Center, Greenbelt, Maryland

An interferometer objective lens (or diverger) may be used to transform a collimated beam into a diverging or converging beam. A typical objective lens is optimized to deliver a diffraction-limited beam to an optic or optical system under test. Often, imaging performance with respect to the interferometer pupil is not optimal. The center of curvature test for the James Webb Space Telescope required a better solution.

This innovation provides an objective lens that has diffraction-limited optical performance that is optimized at two sets of conjugates: imaging to the objective focus and imaging to the pupil. The lens thus provides for simultaneous delivery of a high-quality beam and excellent pupil resolution properties.

A typical objective lens can also introduce objectionable back reflections (or ghosts) into the interferometer, which can produce visible interference rings. This interference degrades, and can even mask, the quality of the measurements being made. The new lens eliminates this common problem. For each surface in the objective lens, the absolute value angle of incidence of the marginal rays is maintained above a minimal threshold for beam delivery. Angle of incidence control has the effect of producing highly divergent and out-of-focus reflections with low intensities at the entrance to the interferometer. The results are minimized ghosting and improved data quality.

This objective lens is suitable for any kind of testing or sensing using an interferometer when high spatial resolution is required, and is especially well suited for tests that include segmented optical components or large apertures.

This work was done by Gene Olczak of ITT Space Systems Division, LLC for Goddard Space Flight Center. For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810. GSC-15675-1

CMOS Camera Array With Onboard Memory

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A compact CMOS (complementary metal oxide semiconductor) camera system has been developed with high resolution (1.3 Megapixels), a USB (universal serial bus) 2.0 interface, and an onboard memory. A compact design of a 2×4 in. (≈5×10 cm) multilayer PCB (printed circuit board) was designed that contains the CMOS socket, a PLD (programmable logic device) for the digital logic required to drive the CMOS array, the USB 2.0 interface, and a RAM (random access memory) chip for storing up to nine images in a compact format. The system can be configured as a slave, which allows the camera to receive a trigger from another similar camera to synchronize exposure, or in master mode, in which the camera receives a trigger command from a computer and sends a trigger to other cameras for synchronization.

Exposure times, and other operating parameters, are sent from a control PC via the USB port. Data from the camera can be received via the USB port and the interface allows for simple control and data capture through a laptop computer. The software designed for this system manages synchronized image capture as used in Pentacam with CMOS sensors, and no frame-grabbers so the power consumption is minimal.

Since the cameras can be triggered and synchronized, they can be used to capture images of high-speed events from several directions. Remote sensing applications also can take advantage of these systems.

This work was done by Nahum Gat of Opto-Knowledge Systems, Inc. for Goddard Space Flight Center. For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810. GSC-14902-1