A 33-Megapixel 120-Frames-Per-Second 2.5-Watt CMOS Image Sensor With Column-Parallel Two-Stage Cyclic Analog-to-Digital Converters


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A 33-megapixel 120-frames/s (fps) CMOS image sensor has been developed to improve the quality of moving images of 8K Super Hi-Vision (SHV). The image sensor includes on-chip column-parallel, two-stage, cyclic analog-to-digital converters (ADCs). The pipelined and parallel operation of the first- and second-stage cyclic ADCs effectively reduces the conversion time. The image sensor with the ADC architecture and 96 parallel low-voltage differential signaling output ports achieve a data rate of 51.2 Gb/s. An experiment revealed that the sensor could run at a frame rate of 120 fps with a power consumption of only 2.5 W. Images recorded at 120 fps have sufficient resolution for use in 8K SHV, and the quality of images of moving objects is superior to those recorded at 60 fps.

Compensation Method for Phase Fluctuation in Holographic Data Storage

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Holographic data storage is a promising method used to create a memory with a large capacity because data are recorded three-dimensionally as interference fringes. The interference fringes are recorded using reference and object laser beams.

A method that records accurate information of an object beam is discussed. Before conducting our experiment, the effect of phase fluctuation was calculated using coupled wave theory. Simulation results showed that the fringe amplitude decreased as the phase noise level increased. We propose a method for phase compensation even if a modulated object beam, which consists of black-and-white pixels, is used with a millisecond recording time. A recording experiment was conducted in which even pages were without compensation and odd pages were with compensation with 100 angle multiplexing. The obtained results indicate that the mean brightness was increased by 2 x 10^5, and the mean error count for each page was reduced from 17 to 13 by improving the diffraction efficiency. This technology is feasible and effective for realizing holographic data storage systems.

Sensation of Realness From High-Resolution Images of Real Objects

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We performed subjective assessments to quantify the sensation of realness for images at various angular resolutions and that of their real-object counterparts using a paired-comparison procedure. Both the images and real objects were viewed through a synopter, which removed horizontal disparity and presented the same images to both eyes. The size, perspective, luminance, and chromaticity of the images were reproduced to be identical to those of the real objects. Eighty-two observers with normal vision were asked to choose the viewed image that appeared most similar to the real object. The results indicated that the realness of images increased steadily as the image resolution increased up to around 60 cycles per degree, whereafter it gradually approached that of the real objects.