

5.6 Self-pumped Photorefractive Phase-conjugate Mirrors for Thresholding Applications

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Holographic associative memory systems are one of the most promising applications in the field of holography. Pictorial images are stored in a multiple-exposure volume hologram which is illuminated with the partial input during the retrieval step. This results in distinct beams each centered angularly about the direction of one of the reference beams used in the recording step. The most intense of these reference beams is the one whose corresponding stored image most closely resembles the partial input. The most intense reference beam is selected by a thresholding process and is phase conjugated to read-out the "output" hologram. Our aim is to combine optical intensity thresholding with optical phase conjugation by using a self-pumped phase conjugate mirror with a ring cavity.

The intensity thresholding properties of several configurations of self-pumped phase conjugate mirrors with a ring cavity and an Fe:KNbO₃ crystal have been investigated. When working in a regime of saturated reflectivity—which means that we wait for a sufficient time for the phase conjugation to establish at lower intensities—we found a threshold–intensity level which can be controlled either by the dark conductivity of the photorefractive crystal or by an additional background illumination of the crystal. As a better solution to vary the intensity–threshold we propose a clock–controlled thresholder. In this configuration the result is read-out after a fixed clock-time-interval. Such a configuration has an advantage in the simplicity of threshold adjustment and is better compatible with normal processor architectures which are controlled by a central clock. Our next goal will be to demonstrate the optical intensity thresholding phase conjugation device which operates simultaneously in three different channels.