

5.4 Intensity Thresholding and Reflection Gratings in Self-Pumped Phase-Conjugate Mirrors

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Intensity thresholding in a self-pumped phase conjugate mirror with a ring cavity is investigated in order to use it for an intensity thresholder in all optical data processing and associative memory system. Our ring cavity self-pumped phase conjugate mirror is constructed around a Fe-doped KNbO₃ crystal. In the analysis we consider six possible two wave mixing processes in the photorefractive crystal and select the crystal orientation such as to maximize these coupling in the two wave mixing processes which are desirable.

We study the mechanism of operation of a ring cavity self-pumped phase conjugate mirror and focus our interest to the influence of reflection gratings on the response time and the reflectivity of the mirror. By using a vibrating mirror in the ring cavity and the coherence length of the laser over the length of the ring cavity, the response time becomes short and the reflectivity increases. The results show that the build-up of reflection gratings in ring cavity self-pumped phase conjugate mirror present an obstacle for good performance.

Our self pumped conjugate mirror was shown to have a thresholding level for the stationary and transient operation. The intensity threshold level can be changed by using additional incoherent illumination for erasure of generated gratings. More importantly, we have proposed a time sharing thresholder which also has a good thresholding property and a faster response.