Topic 12: Spatial Light Modulators and Applications

Aim

Review of optically and electrically addressed Spatial Light Modulators and their applications in optical processing, including the optical correlator and the Joint Transform Correlator. Additional material on modern optical system will be included as time allows.

References

Subject rather too modern to be in the textbooks yet. Best review are in the research journals.

- Goodman, Chapter 7 & 8
- Applied Optics special issue on Spatial Light Modulators Vol 31 No 20 & Vol 33 No 14
- Yu Optical Processing and Optical Neural networks, Academic Press 1995

12 Spatial Light Modulators

12.1 Reading a Reflection SLM

A liquid crystal reflection SLM consists of an array of electrically addressable mirror overlaid with a liquid crystal modulating layer. When illuminated with vertically polarised light the “off” mirrors do not alter the polarisation while the “on” mirrors rotate the axis of polarisation by 45°. Sketch an optical system to read this SLM so that the “on” mirrors are bright.

If the SLM intensity reflectivity of 40%, estimate the optical efficiency of this system, where the optical efficiency is defined as the ration of intensity of an “on” mirror over the input intensity.

12.2 Optical Processing System

A 4-f optical processing system has a 256 × 256 pixel reflective Spatial Light Modulator using liquid crystals in both the input and Fourier plane. Sketch an optical system that uses only one Fourier transform lens. (Hint: Use the read system in question 12.1 twice.)

If the pixel separation of pixels on the Spatial Light Modulators is 30µm and the system us illuminated with He-Ne laser light. Calculate focal length of Fourier transform lens so that the extent of the size of Fourier plane matches the size of the SLM.