

**Title :** Efficiency of Algorithm for creating hologram using spatial light modulation (SLM)

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## ABSTRACT

This thesis presents a study of the effectiveness of algorithms implemented in a Spatial Light Modulator (SLM), which is used for generation of the arbitrary light patterns. **SLMs** play a crucial role in holography by precisely modulating the phase of light to generate interference patterns essential for hologram formation. The quality of holograms heavily

depends on the algorithm used to compute the phase pattern required for optimal light distribution.

The application improves accuracy and ease of use Magneto-Optical Trap (MOT) in terms of efficiency. While optical tweezers also use focused laser beams to manipulate microscopic objects, holographic 3D images are created by the interference pattern generated by the SLM and reconstructed by illumination. Apertures and lenses shape and focus the laser beam within the holographic system.

In this study create 3x3 image by python code and create hologram form SLMs. we have experimented with 4 algorithms: Random Mask or RM each pixel has random phase shift but phase will be random between 0 to  $2\pi$  the technique is very fast and performs remarkably good as far as uniformity is concerned. Superposition S this though slower than RM give order one efficiencies but very poor uniformities. Superposition Random or SR improved from S and results better than S by adding a random phase ( $qm$ ) also produce good uniformity. Gerchberch-Saxton or GS optimize phase by repeating many iterations given result in poor uniformities. It analyzes and compares the efficiency ( $e = \sum_m I_m$ ), uniformity, and standard deviation of several algorithms used to create holograms using a Spatial Light Modulator (SLM)

In addition, this thesis also presents the results and study of the holograms generated by the SLM. Different algorithms have different phases calculations give different efficiencies. Studying this control will help us create good hologram for applications in technology computer and other fields.

□ **Title name guide.**

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