博士論文を要約したもの

博士論文題目
透過型液晶ディスプレイを用いた調光のためのソフトエッジオクルージョンシステムの開発と最適化

氏　　名
Hu Xiaodan

（要約）
Systems featuring light dimming and occlusion capabilities, such as those used in vision augmentation, image processing, and optical see-through head-mounted displays (OST-HMDs), are increasingly popular. Achieving precise light dimming or occlusion (hard-edge) in these systems often necessitates complex optical designs and results in bulky device volumes. In contrast, the use of transmissive liquid crystal displays (LCDs) offers a simpler approach for creating an occlusion mask, i.e., an area with low light transmittance on the LCD. However, masks created using this method frequently appear defocused (soft-edge), leading to inadequate blocking.

In this dissertation, I present the development of a light dimming system utilizing a single-layer transmissive LCD panel. This system adaptively modulates light based on a specialized modulation method and incorporates an optimization algorithm to enable precise light attenuation. This approach significantly enhances visual comfort by effectively modulating light.

Further, the research explores the perception of soft-edge occlusion through the human visual system. By employing a user-preference-based optimization method, we achieved optimal occlusion mask customization, revealing considerable individual differences in the perception of soft-edge masks and varying requirements for mask size.

The dissertation also introduces a novel approach employing a dynamic pinhole array on a transmissive LCD to optimize the soft-edge occlusion. Positioned

between the eye and another transmissive LCD displaying occlusion, this method features adaptive pinhole patterns and gaze-contingent functionality. Preliminary results indicate that this approach significantly enhances soft-edge occlusion. This is evidenced by an occlusion mask placed at 4 cm being observed sharply through a 4.3 mm aperture, with the focal plane set at 1.8 m.