

See-Through Near-Eye Displays for Vision Correction

Chao Ping Chen, Lei Zhou, Yishi Wu, Keyu Wang, Bing Yu, and Yang Li

Smart Display Lab, Department of Electronic Engineering, Shanghai Jiao Tong University, Shanghai, China

Email: ccp@sjtu.edu.cn

Abstract—See-through near-eye display (NED) is a key component of augmented reality, through which the computer-generated images or videos are displayed on top of the existing environment. Unlike flat panel displays, such as liquid crystal display, NED is wearable and very close to the eyes. Therefore, not just the optical performance of the displays but also the vision acuity of the users needs to be considered. According to a recent study on the global prevalence of myopia—also known as nearsightedness—half of the world’s population will be nearsighted by 2050. Unfortunately, with current NED solutions, users, who are more or less visually impaired, are required to wear extra eyeglasses. If doing so, both the user experience and device performance will be deteriorated, as the device becomes bulky and the eyes are further from the exit pupil. As an alternative, users can choose to wear contact lens or even contact-lens-like NED. But for aged people, it might not be a wise option for their eyes are dry and the removal of the contact lens is not quite convenient. Motivated by the above issue, we propose several compact designs of see-through NEDs, which feature a pair of corrective lenses coated with multiplexed volume holograms. With those designs, for those who have refractive anomalies—e.g. myopia and hyperopia—extra eyeglasses or contact lens are no more needed. Based on numerical simulations, field of view, modulation transfer function, and distortion have been studied.

Keywords—*augmented reality; near-eye display; vision correction; volume hologram*