聚焦 AR/VR：基于超表面器件的近眼显示

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随着超表面技术的发展，越来越多的新颖超表面器件被应用于 AR/VR 近眼显示系统中。为总结近年来超表面技术在近眼显示中的发展进步，上海交通大学苏翼凯教授、李燕副教授研究团队回顾了基于超表面器件近眼显示的最新进展。

首先介绍了 VR 和 AR 近眼显示基本概念，简要解释超表面的工作原理，然后主要回顾了面向近眼显示应用的超表面器件的最新发展，说明了它们在各种 VR 和 AR 架构中的工作原理、功能和性能特征。相比 VR 系统，AR 系统中则需要加入光学融合器实现虚实融合的功能。超表面器件可以作为 AR 显示架构中的关键光学元件，如目镜、光学融合器等，取代传统的笨重光学元件或集成新的先进光学功能，以实现更紧凑、更轻便、高图像质量、大 FOV AR 显示。

超表面在 VR 和 AR 近眼显示中具有巨大的应用潜力，可以提高成像性能，扩大视场或增加紧凑性。人们提出了许多自然舒适的 3D 显示方法，包括 Maxwellian-viewing 显示、全息显示、光场显示和变焦显示。由于超薄的外形和出色的光调制灵活性和高度的设计自由度，超表面器件有望为开发紧凑轻便的 VR/AR 头显提供了一个有前途的解决方案。

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Focus on AR/VR: Near-eye display based on metasurface devices

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With the development of metasurface technology, novel metasurface devices have been applied for AR/VR near-eye display systems. To summarize the progress of metasurface for near-eye display applications in recent years, a team from Shanghai Jiao Tong University reviewed the latest progress of near-eye display based on metasurface devices.

The team first introduces VR and AR near-eye displays, and then briefly explain the working principles of light-modulating metasurfaces, review recent developments in metasurface devices geared toward near-eye display applications, delved into several advanced natural 3D near-eye display technologies based on metasurfaces.The architecture of a VR display is relatively straightforward, composed of two main functional components: the image source and the eyepiece. In theory, metasurface devices could serve as either the image source or the eyepiece. However, for VR displays, the image source must provide large-size, video-rate, full-color images to create an immersive virtual environment. This requirement surpasses the capability of the state-of-art metasurfaces. Therefore, the application of metasurfaces in VR displays is primarily restricted to functioning as an eyepiece. Given their versatile functionality, high optical performance and ultra-thin form factors, metasurfaces have been proposed as critical optical components in various AR display architectures. The authors reviewed the applications of metasurfaces in different AR architectures, based on beam splitters, waveguides and direct projection. natural 3D display approaches have been proposed, including Maxwellian viewing display, holographic display, light field display, and multi-/vary-focal displays.

Thanks to their ultra-thin form factors and exceptional flexibility in light modulation, metasurfaces offer a promising solution for the development of compact and lightweight VR/AR headsets.

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