Ansys

CASE STUDY /

Ansys + VividQ

"There's no point in reinventing the wheel here — Zemax supports our need for ray-based optical design excellently, and we're able to work in a format with which our clients and collaborators are already familiar."

Alfred Newman
Head of Research / VividQ

CASE STUDY

Using Zemax, VividQ introduces Computer-generated Holography to Augmented Reality Devices

Holography is no longer the stuff of science fiction. Modern optics make it possible to transpose complex patterns of light into realistic 3D images that can be projected through various devices. This process of engineering light to create 3D projections is known as computer-generated holography (CGH). The consumer and industrial electronics markets make practical use of CGH and optical design, building devices that can inform, entertain, and keep us safe. These include wearable devices for augmented reality (AR) and head-up displays that simulate the surrounding driving environment in cars and other vehicles.

Used together with a spatial light modulator (SLM) and a light source (usually a laser), the VividQ software development kit (SDK) utilizes 3D data from sources like gaming engines and 3D cameras to manipulate the diffraction and interference properties of light, resulting in dynamic, interactive holographic experiences.

Challenges

To successfully utilize the benefits of CGH in their devices, VividQ's customers must house optical systems capable of maintaining high levels of precision, even when the mechanics are scaled down to a very small size. Performance of AR devices with CGH is tied to granular control: the greater precision optical designers can achieve, the more convincing and realistic the resulting holographic user experience. For example, for truly immersive high-performance gaming devices, an optical design should account for accurate field-of-view (FoV) and depth-of-field (DoF) parameters that most AR devices currently on the market fail to achieve.

Other challenges posed by AR device manufacturers include getting the optimal resolution, brightness, contrast, and color accuracy; all factors that depend on accurate and efficient optical design. VividQ SDK addresses these needs by retaining full depth information throughout the high-performance computations. With CGH, manufacturers can also achieve miniaturized form factors of devices by making their optical systems compact and lightweight (weighing 30 g or less).

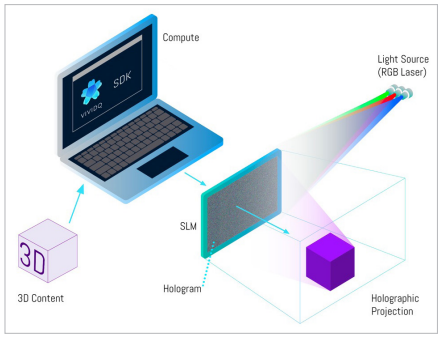
Ansys Products Used

- Zemax OpticStudio Professional

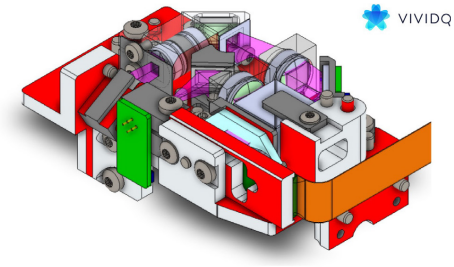
Engineering Solution

Since its early days as a company, VividQ has used Zemax to facilitate the easy and thorough design of optical systems for prototyping purposes. For the 2019 AR Headset Prototype project, Alfred Newman, head of research at VividQ, and his team needed to combine the powerful computing capabilities of VividQ SDK with the precision needed to miniaturize an optical design without sacrificing performance. To achieve this, VividQ used OpticStudio in three key areas:

- **Aberration correction.** The VividQ SDK allows for software correction of optical aberrations. To take maximal advantage of this, VividQ were able to model this behavior in OpticStudio, resulting in diffraction-limited performance using only stock lenses.
- **Tolerancing.** Complying with required manufacturing tolerances for the new hardware meant having a clear understanding of system performance under various conditions, and the ability to test multiple lens options rapidly and iteratively.



- **AD integration.** VividQ made use of the standardized workflow between optical design and mechanical engineering teams enabled by OpticStudio to produce a manufacturable design that could be easily exported to CAD for production. Using specification data from the OpticStudio lens catalog, VividQ applied various permutations of stock lenses in OpticStudio, modeling and visualizing each one to check for tolerance fitting and gauge overall performance. When they had the design they needed, the OpticStudio integration with CAD enabled them to simply export the design in a format that was ready for their optomechanical partners to pick up and start building.



/ Benefits

The simplicity of this end-to-end process makes computer-generated holography an easily accessible display technology to original design manufacturers (ODMs) that want to design and manufacture high-performance AR products but feel intimidated by the complexity of CGH design.

“Zemax makes it very easy to design and integrate CGH within a product development supply chain,” said Newman. “ODMs can use OpticStudio to find the right lens configuration with the correct tolerances, and then use VividQ software to generate holograms from a wide range of 3D data sources. When they’ve got the design they want, they can export it using CAD, ready to manufacture.”

Since presenting their Headset V2 Prototype in 2020, VividQ has become a de facto thought leader in bringing CGH products to market using a streamlined design process together with VividQ SDK for image processing. ODM adoption has been swift, thanks largely to Zemax serving as a common basis for project communications, as well as its extensive lens data library.

“The biggest time-saver for us was how widely adopted Zemax is in the industry,” said Newman. “When we want to collaborate with a partner, we can collaborate on an optical design without needing any translations. By using OpticStudio, we’re speaking the same design language as the ODMs.”

/ Company Description

Based in London and Cambridge, U.K., VividQ specializes in software and hardware intellectual property licensing for CGH to help companies produce high-quality devices that integrate digital content with depth of field into the visual world.

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