INSTITUT d'OPTIQUE GRADUATE SCHOOL | Continuing Education
Formation Continue

SC8a | 3D Display: holographic techniques and other geometrical approaches



LEVEL: BASIC

Audience: Senior technicians, engineers, project managers, R & D researchers, and anyone interested in 3D visualization

Prerequisites: Optical bases are required, the more difficult concepts needed to follow the training will be defined during the presentation

Pedagogical manager(s): Pierre-Alexandre Blanche - Associate Research Professor au College of Optical Science, Université d'Arizona (USA)

Language of the training: French

Maximum capacity: 12

Price: 820€ HT - **Duration:** 1 day - 7 h

Objectives

- Understand the principles and limitations of 3D visualization technologies
- Have an overview of modern systems (screen, television)
- Understand the relevance of current research on 3D display

Addressed topics

Foundations of the human visual system
Anaglyphs, active and passive polarization, parallax barriers, Pepper's ghost effect, picture embedding
Limitations of modern systems: volumetric projection, auto-stereoscopic screens, integral imaging, virtual or augmented reality glasses
Diffraction mask, phase modulation devices: liquid crystals, micro-mirrors, acousto-optical cells, photorefractive materials
Limitations of current technology, state of research

SC8a | 3D Display: holographic techniques and other geometrical approaches

The program

Evolution has endowed the human with a three-dimensional vision. We use it every day for the simplest tasks: to find your way around a room, drive a car, shake a hand. Unfortunately, we do not use it in areas where it would be very important: learn, plan, interact remotely. The reason is the lack of a powerful visualization device in three dimensions.
Before talking about technology, one must understand the fundamentals of the human visual system. I will begin my presentation by presenting the different mechanisms and signals allowing vision in three dimensions. From there, we will discuss a brief history of the means that were invented to reproduce some of these signals. We will review techniques such as anaglyphs, active and passive polarization, and parallax barriers. In this description, we will also include systems that are supposedly 3D, but not necessarily so, such as the "Pepper's Ghost" effect, or the image overlay.
Continuing our tour, we will see the advantages but especially the limitations of the most modern systems including volumetric projection, auto-stereoscopic screens (and integral imaging), and virtual or augmented reality glasses. This will lead us to define an ultimate and perfect system for absolutely reproducing all spatial visual indicators. We will see at this point that the wavefront is an important factor and one of the ways to reproduce it is holography.
After a brief introduction to diffractive optics and the generation of static holographic images, we will discuss dynamic holographic devices, with the computation of the diffraction mask, and phase modulation devices: liquid crystals, micro mirrors, acoustic cells optics, and photorefractive materials. We will see what are the limitations of the current technology and will take a look at the state of the research through the various published works with, if possible, demonstration videos of the different systems.
I will brighten the presentation with examples from science fiction that will demonstrate the benefits but also the possible applications.
Man is born to see in three dimensions, it is time for research to provide a system that lives up to our natural potential.
Outline

- Physiology of 3D vision
- Historical background
- Stereoscopic system
- Fake friends
- Volumetric systems
- Auto-stereoscopic systems
- Diffractive optics and holograms
- Dynamic diffractive devices
- State of research and future developments

Methodology and assessment

Lectures and illustrations, videos
This training can also be followed in the framework of the 4-day training entitled "Holography: from measurement to 3D display" (SC8)