

# Virtual Reality

**Lecturer**

Gauthier LAFRUIT (Coordinator)

**Course mnemonic**

INFO-H502

**ECTS credits**

5 credits

**Language(s) of instruction**

English

**Course period**

First term

**Campus**

Solbosch

## Course content

Nowadays, virtual reality (VR) is no longer limited to a projection of synthetic 3D content (aka OpenGL = Open Graphics Library, cf. 3D games) in a stereoscopic head mounted display. Indeed, the future of VR lies rather in the holographic projection of real/natural content (e.g. Google Starline), previously captured by conventional cameras (360 video) possibly augmented with depth estimation or sensing in order to obtain a totally immersive video at 6 Degrees of Freedom (6DoF). Theoretical concepts like the 3D graphics pipeline on a GPU (Graphical Processing Unit) with its 3D content (3D meshes made of triangles), camera, projection and lighting models, as well as 3D capture and rendering technologies will be presented.

## Objectives (and/or specific learning outcomes)

The student will learn the main aspects of OpenGL/WebGL (practical part; there are no exercises on Unity or Unreal), as well as multi-camera capture and rendering methods in immersive 6DoF video (theoretical part) which are partially based on concepts of OpenGL.

## Pre-requisites and co-requisites

### Required knowledge and skills

C/C++ programming skills are strongly recommended (medium level).

## Teaching method and learning activities

The exercises will help the student to develop a 3D game in OpenGL/WebGL with shaders in GLSL (Graphics Library Shader Language), while the theory will give the student all the skills required to understand a scientific article on immersive video in depth.

## Contribution to the teaching profile

3D next-generation capturing and rendering techniques for multimedia engineers.

## References, bibliography and recommended reading

JungHyun Han, "Introduction to Computer Graphics with OpenGL ES," CRC Press, 31 March 2021, 978-0367781187

Joey de Vries, "Learn OpenGL: Learn modern OpenGL graphics programming in a step-by-step fashion," Kendall & Wells, 17 June 2020, ISBN: 978-9090332567

Gauthier Lafruit, Mehrdad Teratani, "Virtual Reality and Light Field Immersive Video Technologies for Real-World Applications," Institution of Engineering and Technology, 1 December 2021, ISBN: 978-1785615788

## Course notes

Syllabus, Université virtuelle and Podcast

## Other information

### Place(s) of teaching

Solbosch

### Contact(s)

Office ULB-Solbosch UD5.007

Phone: 02/650 30 82

Email: gauthier.lafruit@ulb.be

## Evaluation method(s)

Oral examination and Project

### Evaluation method(s) (additional information)

OpenGL/WebGL project + open book exam for the theoretical part (6DoF immersive video, mainly).

## Determination of the mark (including the weighting of partial marks)

The score is built for 50% on the OpenGL/WebGL project, and for 50% on the theoretical exam (open book) where the student will have to present a scientific concept covered by one of the chapters and/or scientific articles presented (sometimes only partially) during the theoretical sessions of the course.

## Main language(s) of evaluation

English

## Other language(s) of evaluation, if applicable

French

## Programmes

### Programmes proposing this course at the Brussels School of Engineering

MA-IRCB | **Master of science in Biomedical Engineering** | finalité Professional/unit 2, MA-IREL | **Master of science in Electrical Engineering** | finalité electronics and information technologies/unit 2 and MA-IRIF | **Master of science in Computer Science and Engineering** | finalité Professional/unit 1 and finalité Professional/unit 2

