# UCL  Faculté des sciences appliquées

## FSA

**INGI2325**    Systèmes graphiques et applications

[30h+15h exercises] 4 credits

This course is taught in the 2nd semester

**Teacher(s):**          Yves Willems
Language:                french
Level:                   2nd cycle course

## Aims

- Master the fundamental concepts in the field of Computer Graphics, in particular the high-level notions which allow to minimize the impact of hardware characteristics and facilitate the construction of well-structured programs.
- Know the principles underlying the main algorithms for object visualisation: line drawing, raster conversion, clipping, transformations, projections (perspective), shading, hidden-surface elimination.
- Understand the structure of software packages for graphics applications.
- Learn to construct software for graphics applications.
- Know the most important techniques for modelling threedimensional objects.

## Main themes

- Hardware for graphics systems.
- Fundamental concepts of computer graphics software.
- Data structures used in graphics applications.
- Study of specialized algorithms: line drawing, polygon filling, transformations, clipping, perspective projection, visible-surface determination, ray tracing, radiosity.
- Study and use of standard software packages for graphics applications.
- Modelling surfaces and threedimensional objects.

## Content and teaching methods

- Fundamental algorithms for the visualisation of 2-D primitives on raster hardware: lines, circles, polygons, clipping, filling.
- Geometrical transformations (2-D and 3-D), projections.
- Representations of curves and surfaces: polygonal meshes, parametric cubic curves, parametric bicubic surfaces, fractal models, grammar-based models.
- Solid modelling using boolean operations, sweeping, spatial partitioning.
- Human perception of light and color.
- Visible-surface determination algorithms: z-buffer, scan-line algorithms, ray casting, priority lists, image subdivision.
- Shading models and shadow casting, ray tracing, transparency, radiosity, global illumination.

**Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)**

- Prerequisite:
(1) INGI2592 Data structures
- References
Required textbook:
(1) F. S. Hill, "Computer Graphics using Open GL (2nd ed.)", Prentice-Hall, 2001, 0-13-320326-3.
Recommended textbooks:
(2) Foley, van Dam, Feiner, Hughes, "Computer Graphics: principles and practice (2nd ed.)", Addison-Wesley, 1990, 0-201-12110-7.
(3) Foley, van Dam, Feiner, Hughes, Phillips, "Introduction à l'Infographie (éd. française)", Addison-Wesley, 1995, 2-87908-058-4.
(4) Burger, Gillies, "Interactive Computer Graphics: functional, procedural and device-level methods", Addison-Wesley, 1990, 0-201-17439-1.
(5) Alan Watt, "Fundamentals of Three-dimensional Computer Graphics", Addison-Wesley, 1990, 0-201-15442-0.
(6) Hearn, Baker, "Computer Graphics (2nd ed.), Prentice-Hall, 1994, 0-13-159690-X.
- Organisation
two programming assignments allow the students to become acquainted with the implementation details of some of the algorithms presented in the course (3-D transformations and perspective, hidden surface elimination, ray tracing, ...)
- Note: the programming assignment for this course (which is rather elaborate) requires good programming skills and the use of the UNIX operating system.

**Other credits in programs**

| **INFO22** | Deuxième année du programme conduisant au grade d'ingénieur civil informaticien | (4 credits) |