Faculty of Applied Sciences

INGI2325	Graphic systems and applications

[30h+15h exercises] 4 credits

This course is taught in the 2nd semester

Teacher(s):   Yves Willems
Language: French
Level: Second cycle

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

FSA3DS/IN	Diplôme d'études spécialisées en sciences appliquées (informatique)	(4 credits)
INFO22	Deuxième année du programme conduisant au grade d'ingénieur civil informaticien	(4 credits)
INFO23	Troisième année du programme conduisant au grade d'ingénieur civil informaticien	(4 credits)