

Review

December 1, 2008

We studied the Chapters 1–15 (skip some hardware chapters, skip some parts in different chapters, and take Java 3D instead of PHIGS). The theoretical chapters include the following:

- Geometrical Transformations
- Viewing in 3D
- Representing Curves and Surfaces
- Solid Modeling
- Achromatic and Colored Light
- Visible-surface determination

You will need to review some mathematical background such as

- Line equation
- Plane representation and equation
- Intersection of two lines, a line and a plane, etc.

which relates to vectors and different operations on vectors (addition, dot product, cross product, etc.) The important detail in each chapter is listed below:

- **Geometrical Transformations:** translation, scaling, rotation, and the composition of a sequence of transformations. Window-to-viewport transformation is an application of the definition presented in this chapter. 3D transformations differ from 2D ones in the obvious way (one more dimension).

What we need to know is (very often) to compute a transformation that achieves a given objective. For example, what transformation results in point $P(x, y)$ becomes $P'(x', y')$; thing is more complicated when we want a set of points (e.g. a line) to become another set of lines.

- **Viewing in 3D:** this chapter provides various definitions of projection; how to specify a projection (what needs to be specified) and how to compute a projection. The representation of lines and plane is important. Without a correct representation, it will be impossible to correctly rendering a scene.

What we need to know is to compute the projection from the specification.

- **Representing Curves and Surfaces:** various representations of curves and surfaces are discussed. The advantages and disadvantages of each representation are discussed.

Frequently, the question of determining whether some points will belong to an approximated surface (curve) given the method of approximation.

- **Solid Modeling:** different representations are discussed. It is important to note the regularized Boolean operations. Why are they introduced? What is good/bad about it? How to compute it?

- **Achromatic and Colored Light:** this chapter provides the basics about light and different representations of light. The most difficult part is how to match a given color.
- **Visible-surface determination:** we discuss how a 3D object can be rendered on a 2D plane; this calls for the theory about projection. Adding color and light requires the computation of the intensity of the light at each projected point (or more precisely, a triangle). Furthermore, techniques to determine hidden/visible surface should also be applied.