

第一课 能耗模拟应用概要

课程架构：

- A) 能耗模拟应用概要 – 理论
- B) Rhino 3D建模（基础） – 实践
- C) 练习与答疑 – 上手

第一课 能耗模拟应用概要

课程目标：

- A) 了解能耗模拟基础知识和操作流程；
- B) 掌握Rhino软件三维建模基本方法；
- C) 开始项目的几何建模工作。

一、建筑能耗模拟

定义：建筑能耗模拟是对建筑环境、系统和设备进行计算机建模，并计算出逐时建筑能耗的技术。

原因：70年代石油能源危机 气候暖化
建筑能耗占总能耗20.9% 发达国家一般30% 香港60%
绿色建筑标准

早期软件：美国BLAST、DOE-2；欧洲ESP-r；中国DeST。
空调系统模块TRNSYS。

建筑能耗模拟

标准:

ASHRAE 90.1 建筑能耗标准 Energy Standard for Buildings Except Low-Rise Residential Buildings (1975)

内容:

建筑围护结构、暖通空调系统、生活热水系统、电力系统、照明系统等
能耗模拟方法:

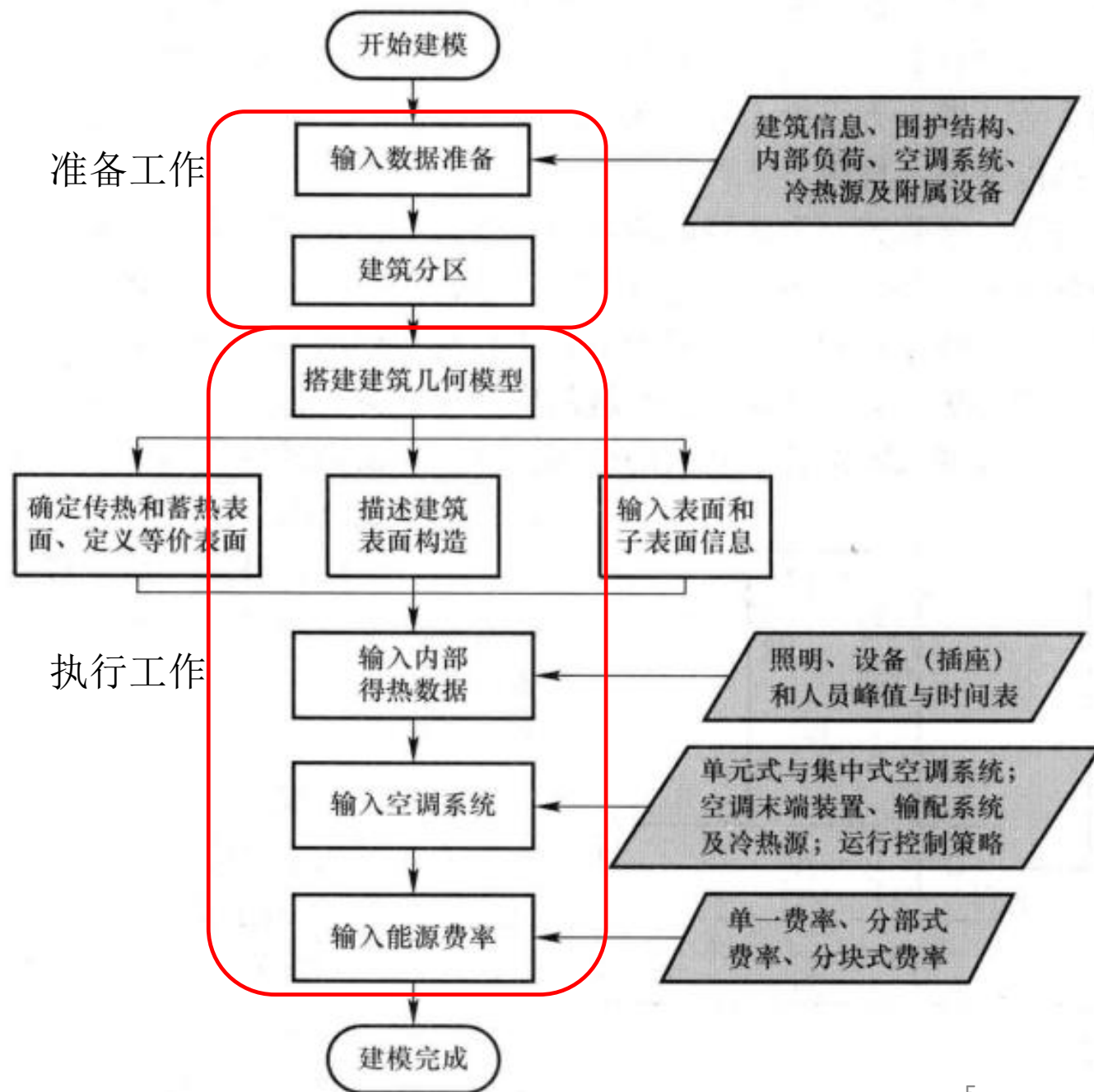
Appendix G – 能耗性能评级方法 (Performance Rating Method)

ASHRAE 140认可软件: Energy Plus, eQUEST, IES, TRNSYS等

建筑能耗模拟

模拟流程：

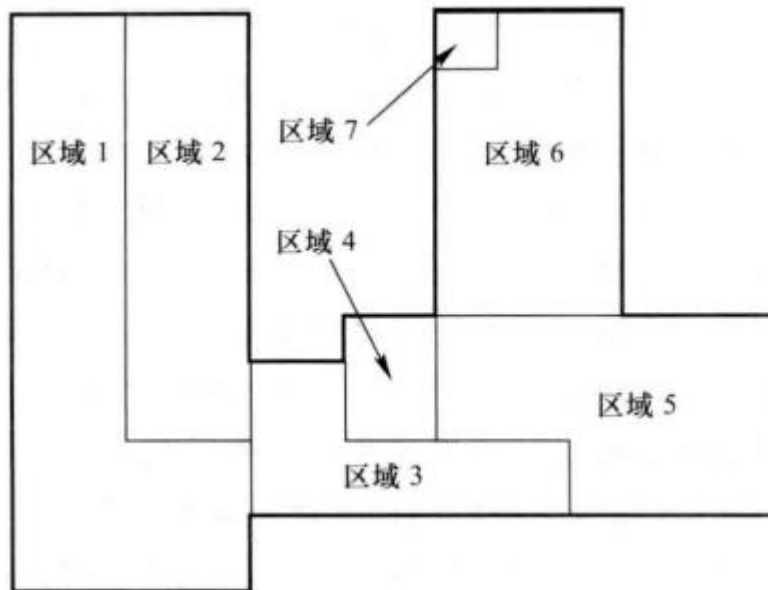
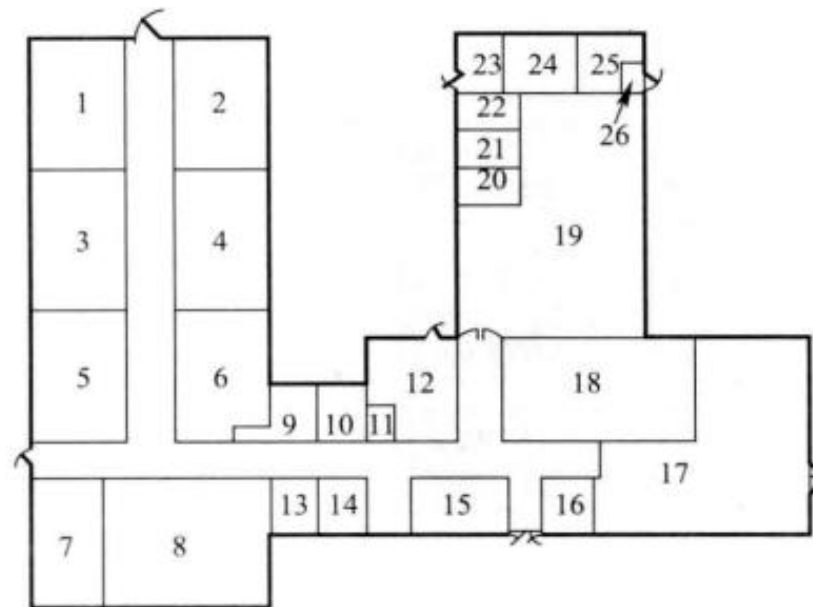
- 气象资料，
- 建筑几何信息，
- 围护结构传热性能，
- 照明，设备，人员，新风负荷，
- 温控策略，
- 系统运行时间表，
- 空调设备



建筑能耗模拟

模拟流程:

- 建筑分区 - 几何意义上
- 热区 - 物理意义上

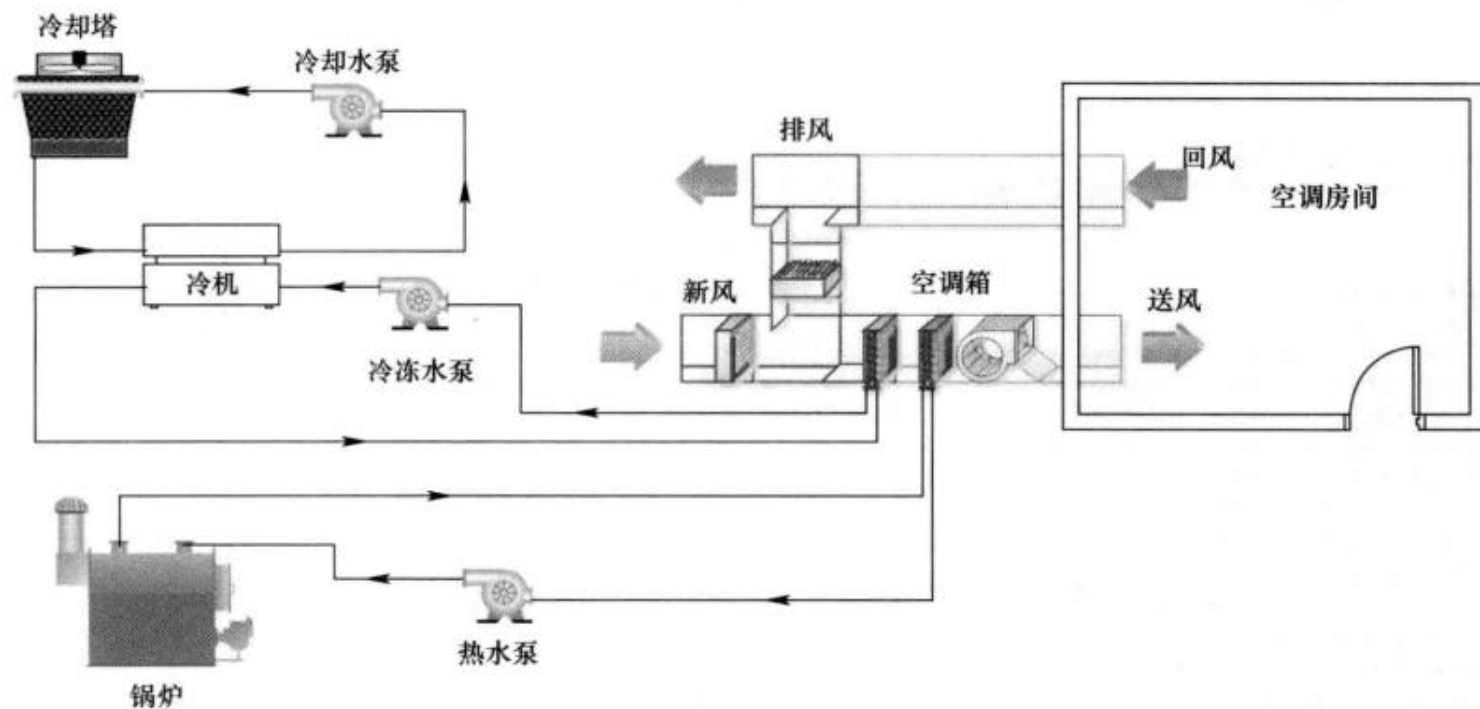


建筑能耗模拟

模拟流程：

空调系统

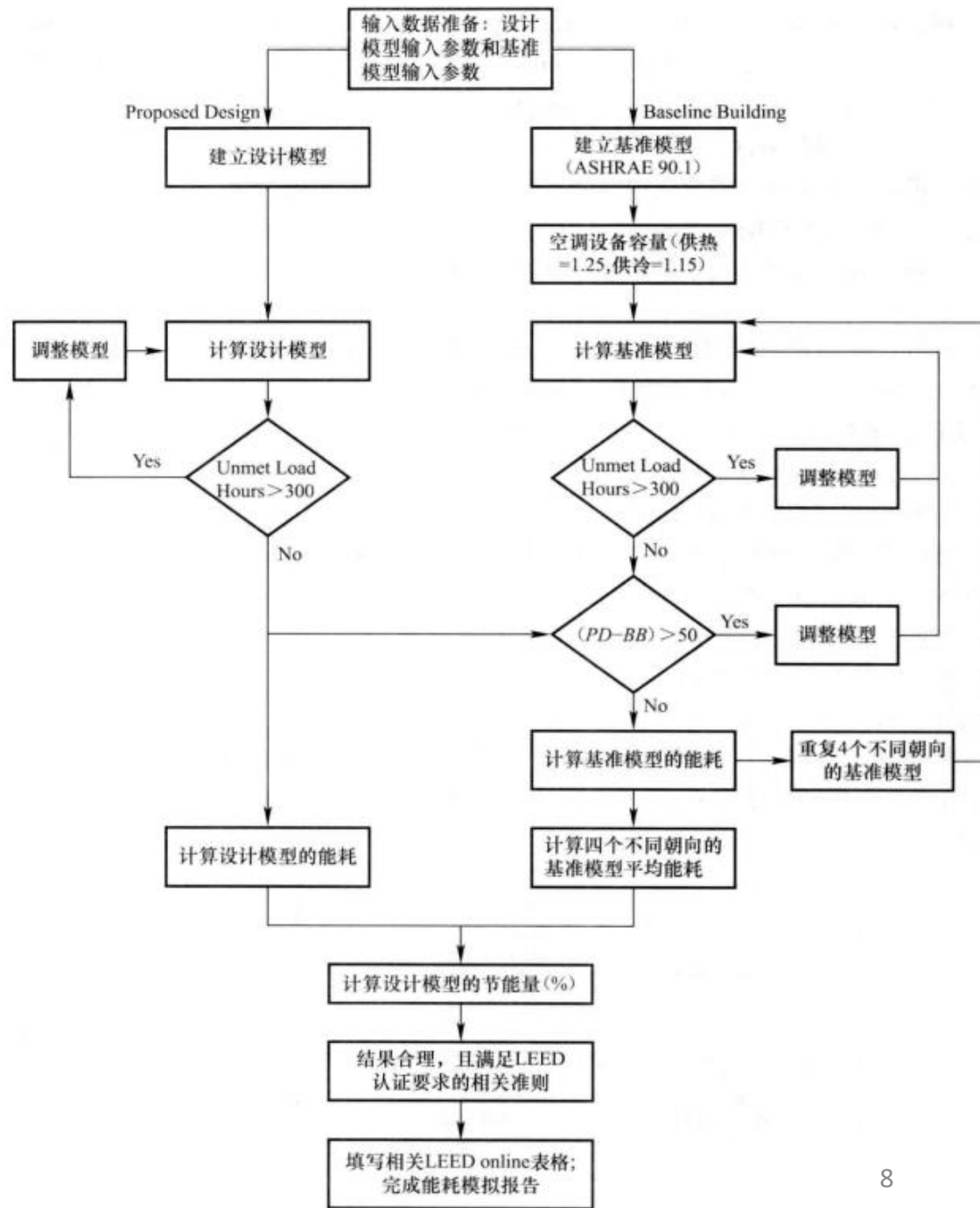
- 定风量+常规水系统
- 风机盘管+独立新风系统
- 变风量系统（VAV）+冰蓄冷系统
- 变制冷剂流量空调系统（VRV）



建筑能耗模拟

LEED标准-模拟流程:

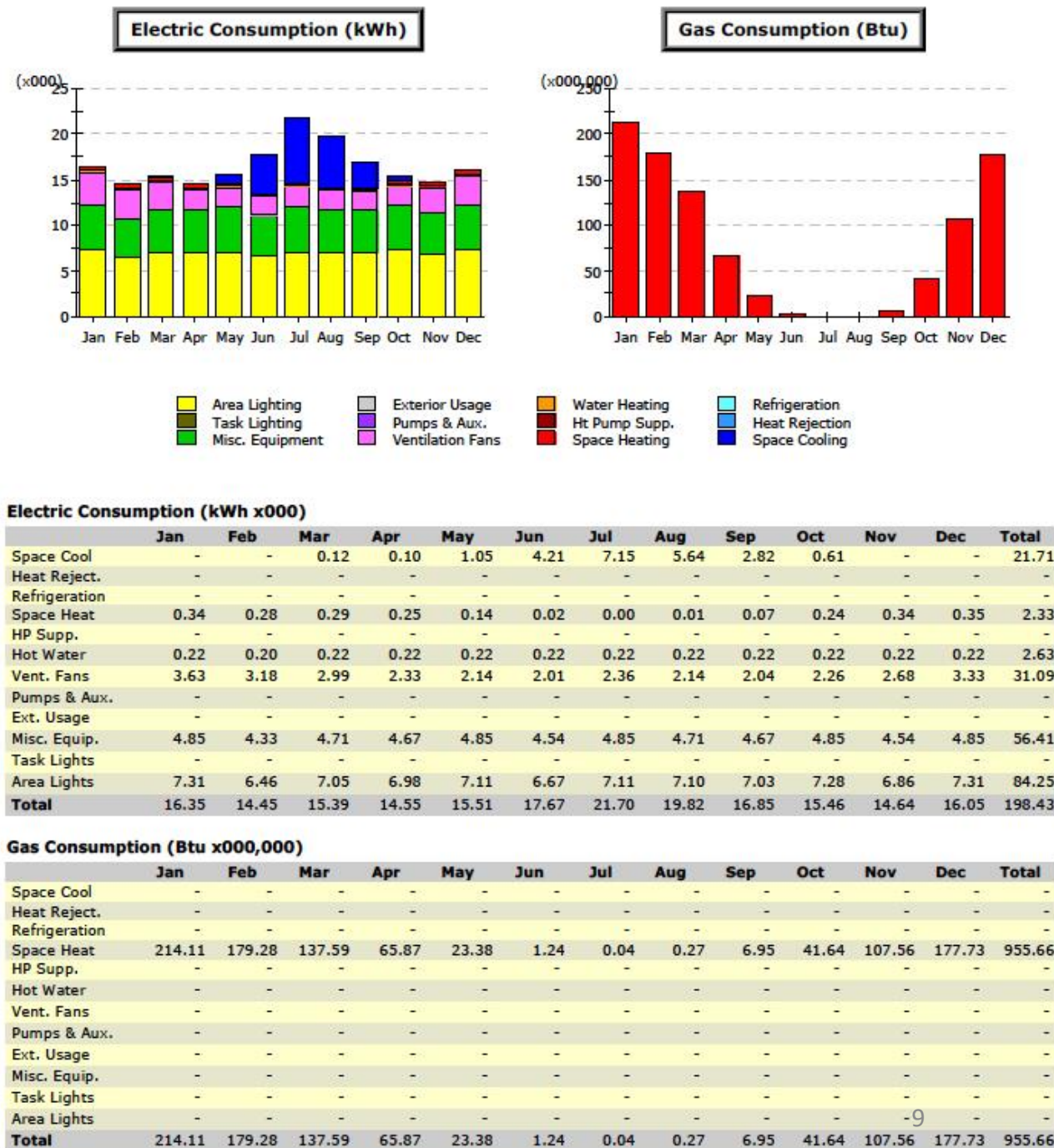
- ASHRAE 90.1 Appendix G 2010
- 不满足时数
- 四个不同朝向



建筑能耗模拟

模拟结果:

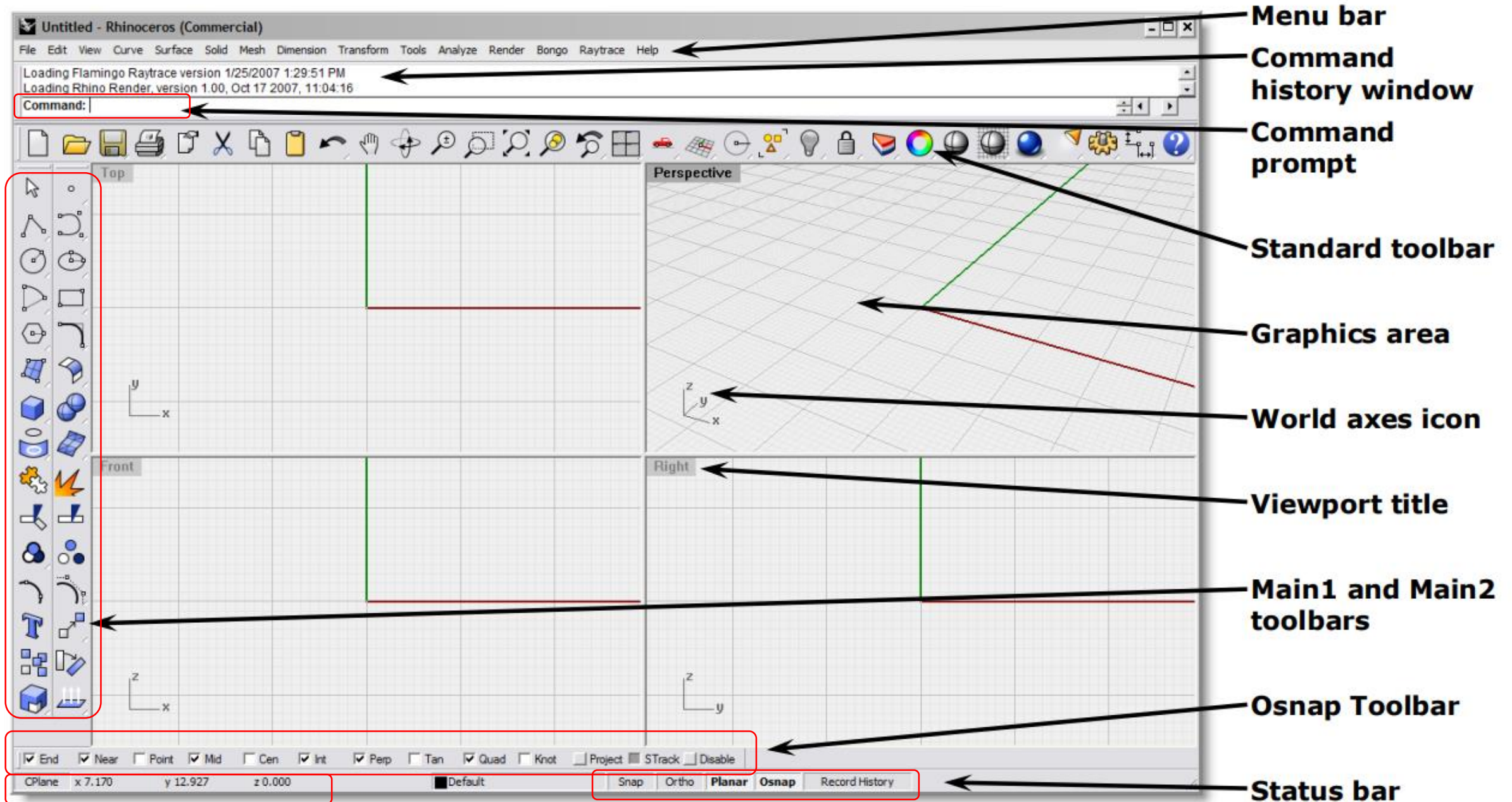
照明、制冷、制热、生活热水、
风机水泵、设备等



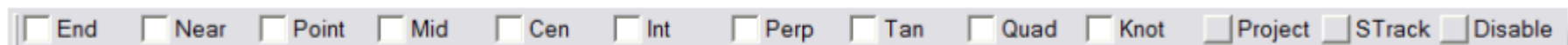
二、Rhino软件建模基础

- 用户界面(GUI) 介绍
- 常用命令
- 显示模式和视角操控
- 创建几何体
- 编辑几何体
- 渲染几何体

Rhino GUI



控制工具



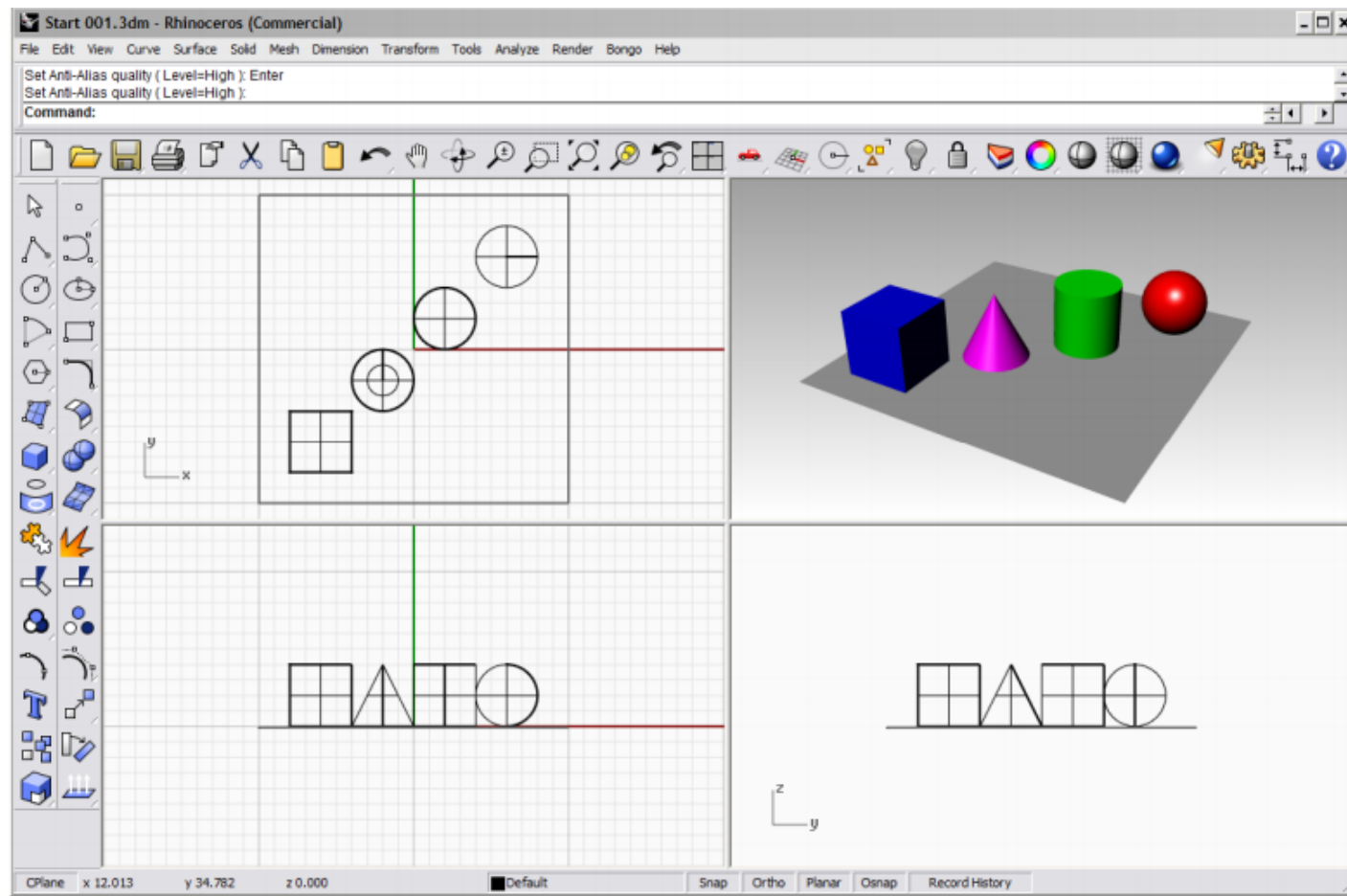
Command	Button	Description
End		End snaps to the end of a curve, surface edge corner or polyline segment end.
Near		Near snaps to the nearest point on an existing curve or surface edge.
Point		Point snaps to a control point or point object.
Mid		Midpoint snaps to the midpoint of a curve or surface edge.
Cen		Center snaps to the center point of a curve. This works best with circles and arcs.
Int		Intersection snaps to the intersection of two curves.
Perp		Perpendicular To snaps to the point on a curve that makes a perpendicular to the last selected point. It doesn't work on the first point that a command prompts you to pick.
Tan		Tangent To snaps to the point on a curve that makes a tangent to the last selected point. It doesn't work on the first point that a command prompts you to pick.
Quad		Quad snaps to the quadrant point. The quadrant point is the maximum or minimum direction on a curve in the x or y construction plane direction.
Knot		Knot snaps to knot points on curves or surface edges.
Project		Projects the snap point to the construction plane.
SmartTrack		SmartTrack is a system of temporary reference lines and points that is drawn in the Rhino viewport using implicit relationships among various 3-D points, other geometry in space, and the coordinate axes' directions.
Disable		Temporarily turns off persistent object snaps, retaining settings

常用命令

由简到难

- Draw Box
- Draw Cone
- Draw Cylinder
- Draw Sphere
- Move
- Vertical Move
- Layer Management

显示模式和视角操控



创建几何体

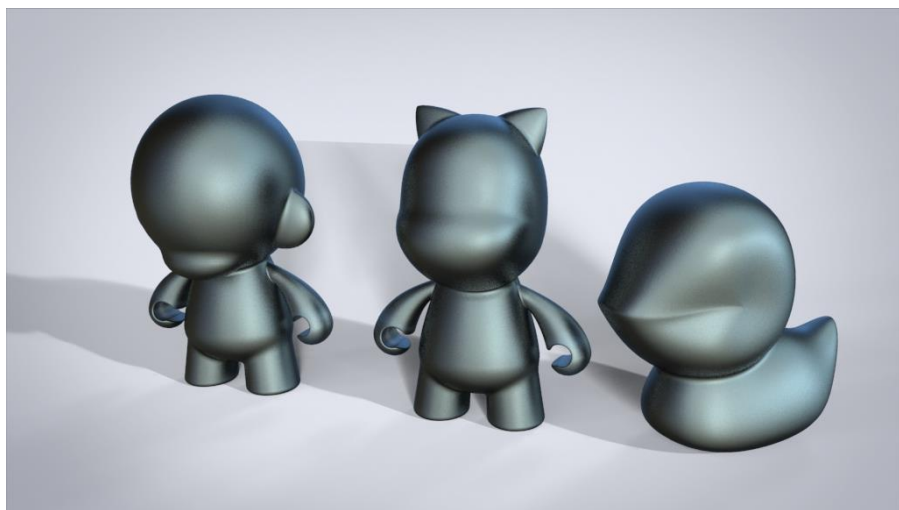
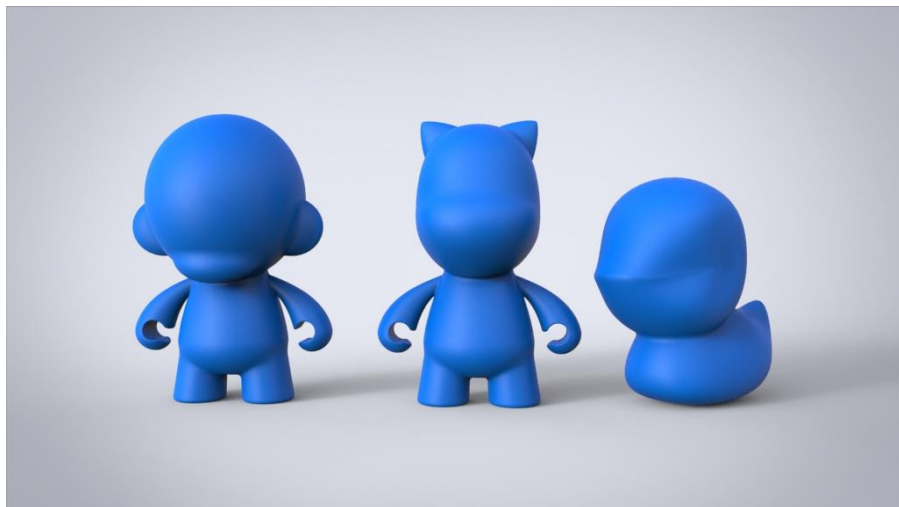
从2D 到3D

- Line/polyline
 - u (undo)
 - c (closed)
- Surface
 - Direct surface
 - Closed line to surface
- Extrude
- Sweep
- Loft
- patch
- Copy
 - v (vertically copy)
- Project
 - project to a surface
 - project to Cplane
- Mirror
- Rotate 2d
- Rotate 3d
- Unit conversion
- Scale

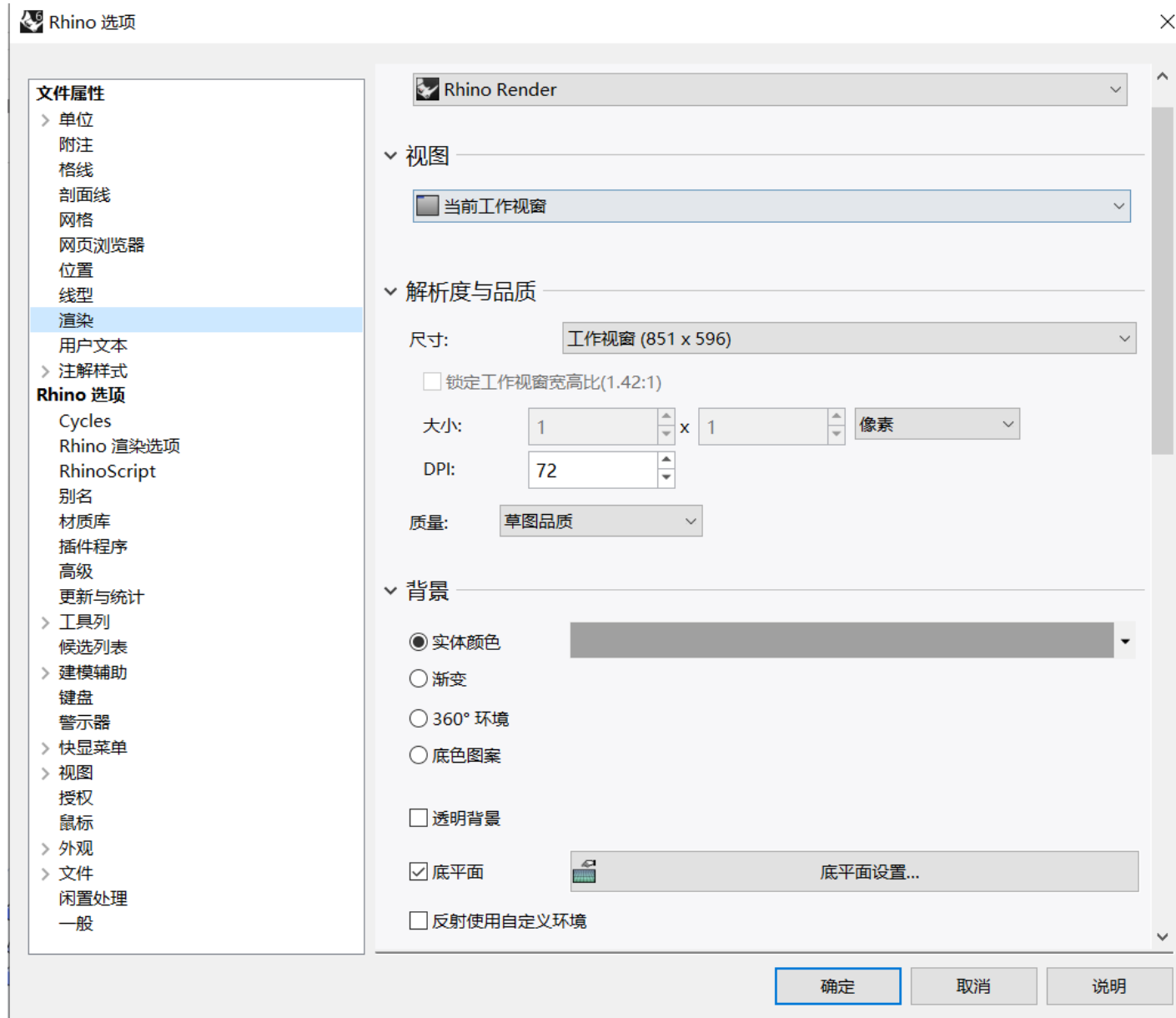
编辑几何体

- Explode
- Extract surface
- Split
- Untrim
- Reconstruct surface (shrink)
- Control points
- Boolean
- Selection / unselection
 - shift + LClick
 - ctrl + Lclick
- selectByLayer
- Multiple Selection
- Selection Filter

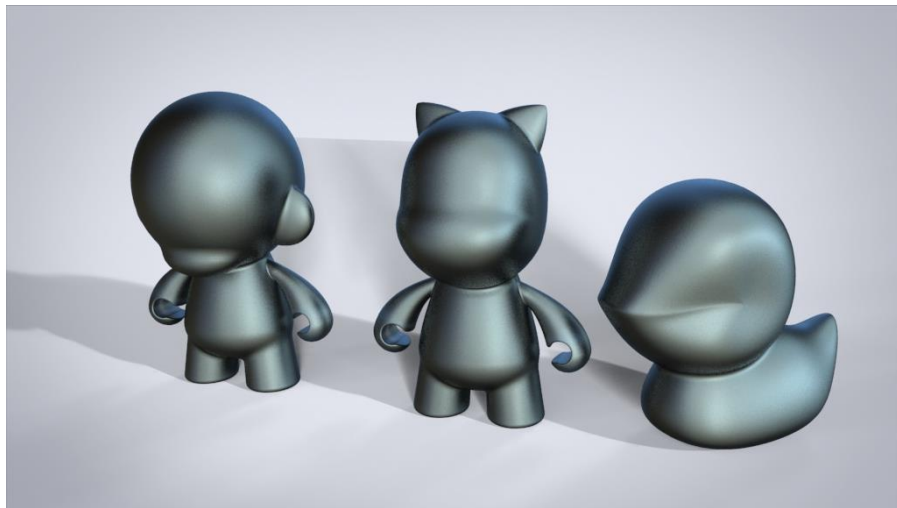
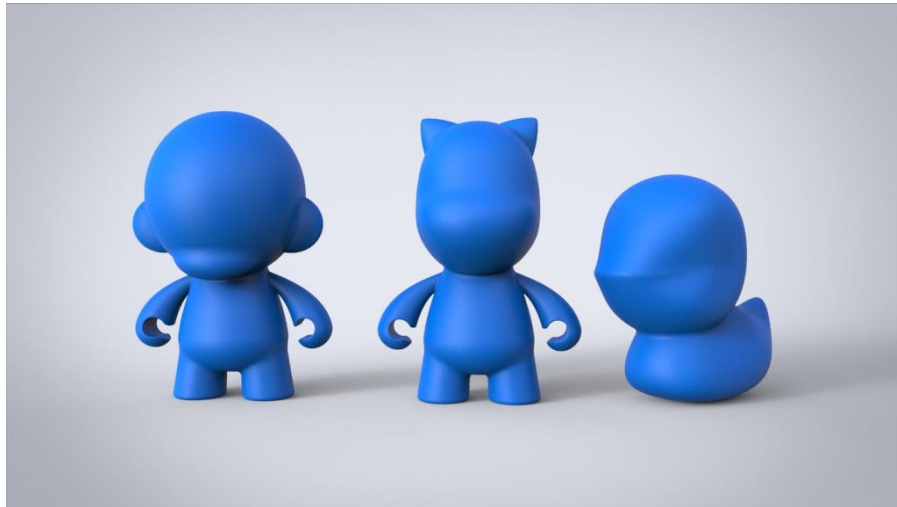
渲染几何体



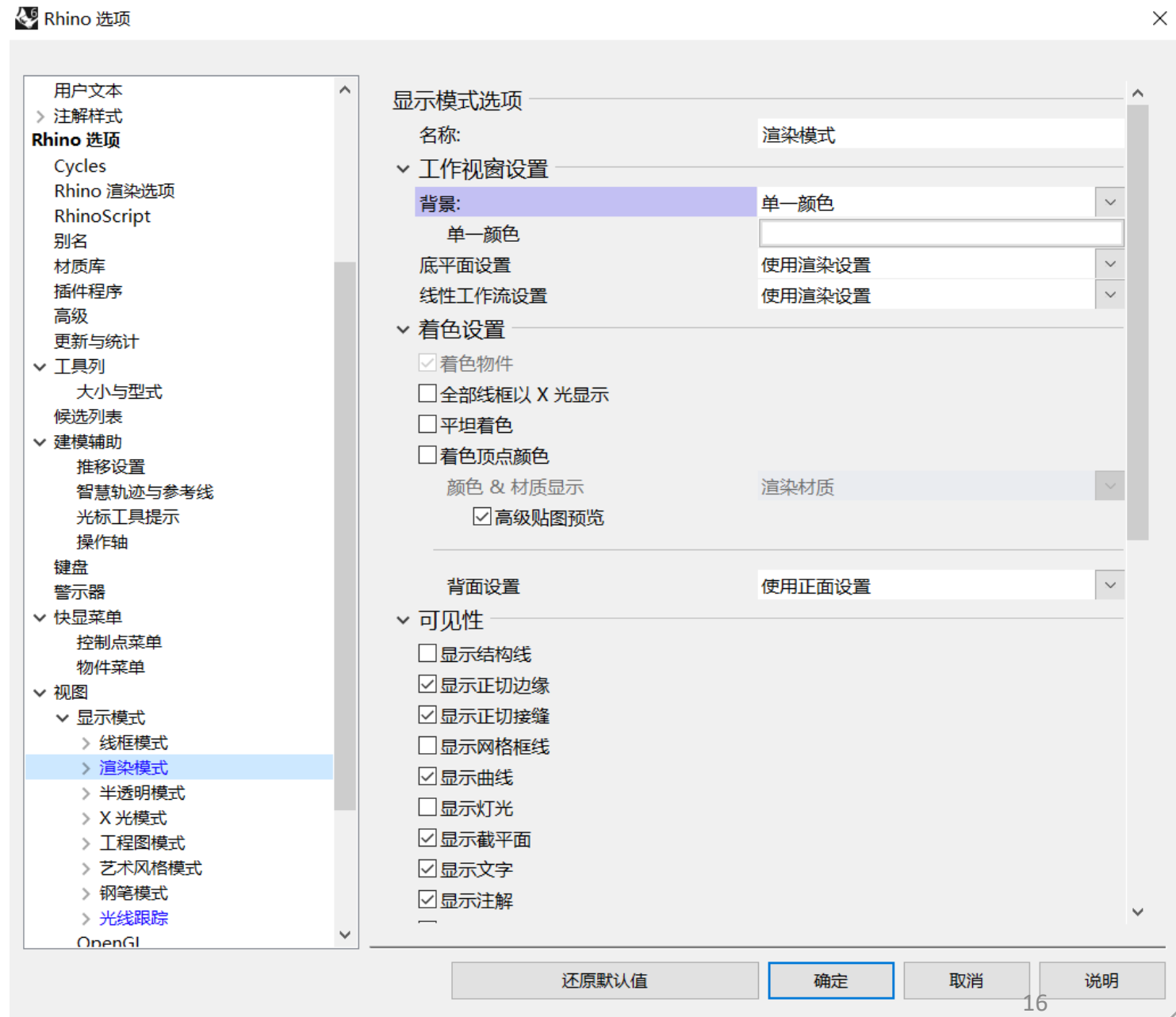
9/21/2019



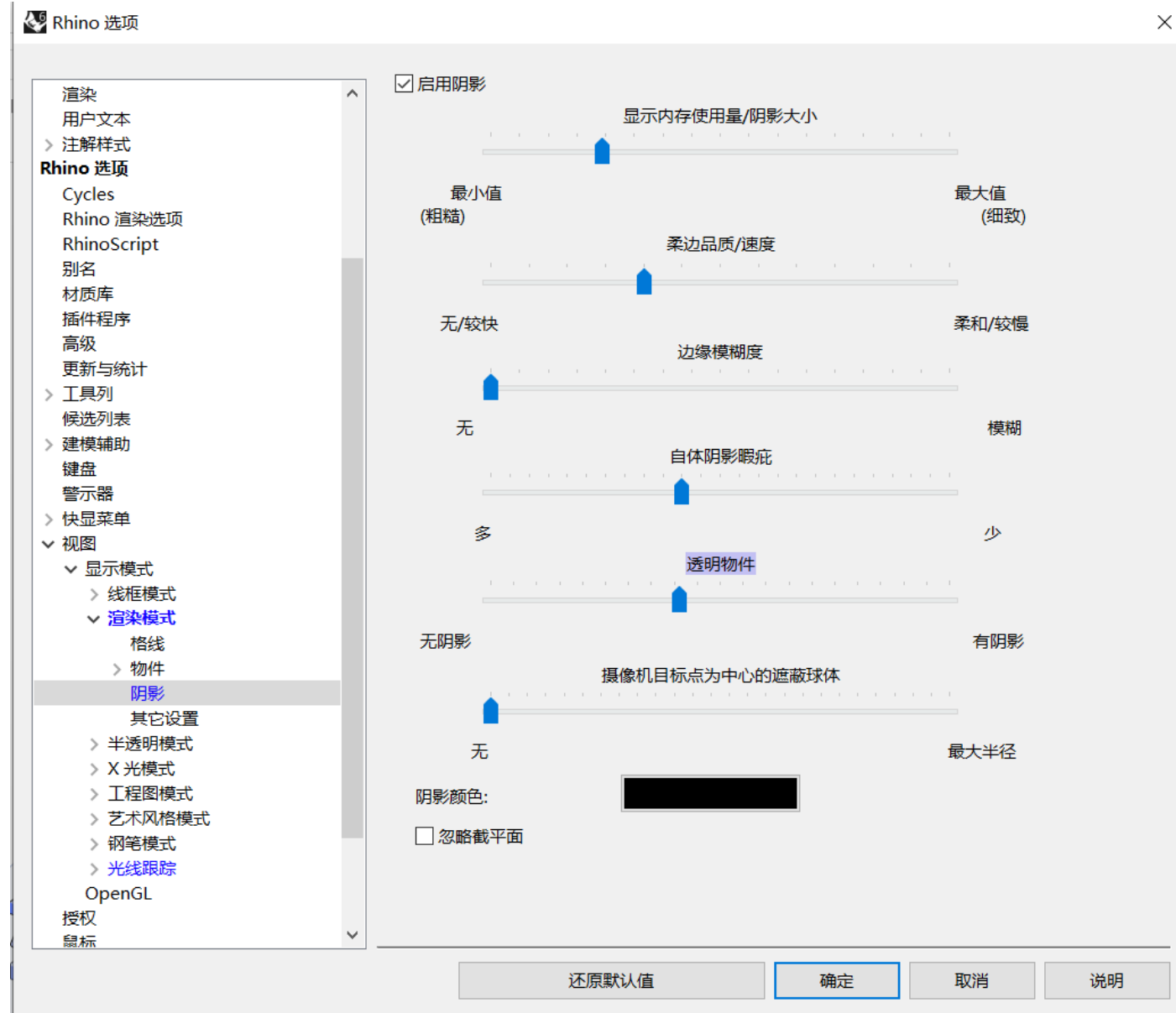
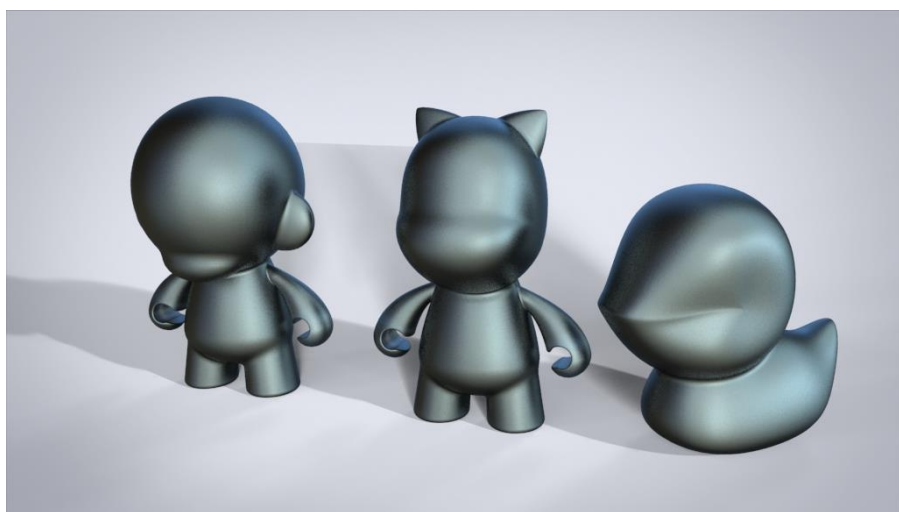
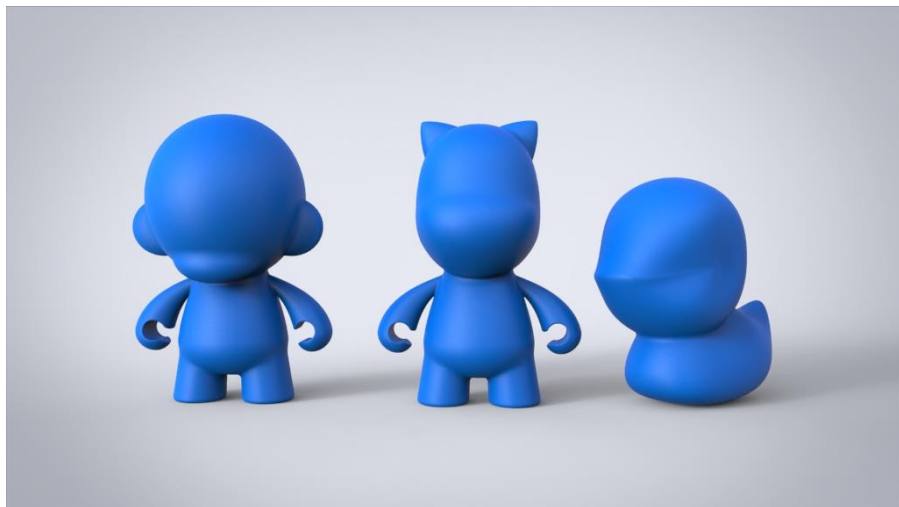
渲染几何体



9/21/2019



渲染几何体

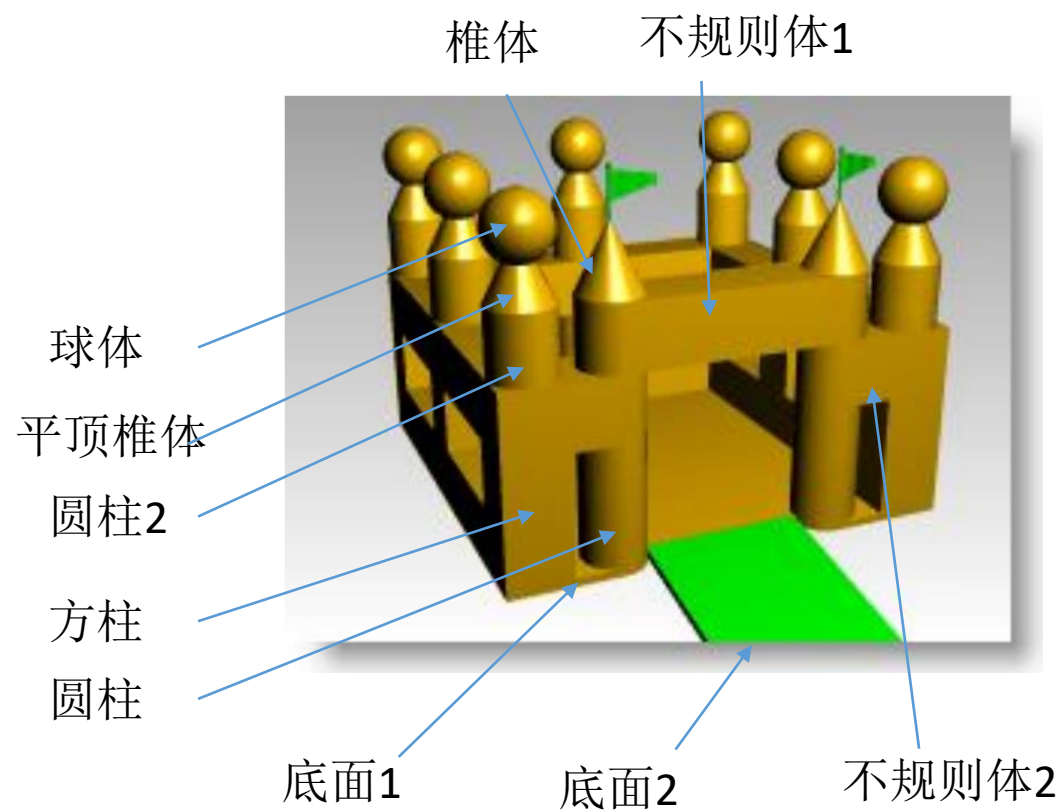
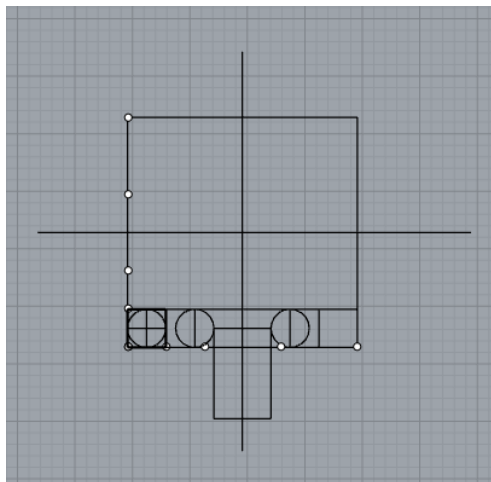


Rhino 图形库

- <https://grabcad.com/library>

小练习

- 思想： 1D 2D 3D
- 图形分解： 体类别， 对称性
- 封闭多段线
- 封闭体
- 图层管理： 线和体



三、项目应用

点石成金：

- autoCAD (dwg) to Rhino
- Pdf to Rhino
- Insert external picture

