Instructor: Dr. Xin (Shane) Li  

Course Description:

- An introductory course to 3D computer graphics, on how to represent, model, and render 3D models and scenes;  
- Good math background and programming skills could easily follow it.

Prerequisites:

- Calculus and linear algebra (vectors, matrices, …)  
- Programming experience: homework and projects require substantial programming effort  
  (You are expected to know C/C++ programming and standard data structures)

Contents:

1. Basic computer graphics pipeline, basic OpenGL programming;  
2. Basic 3D geometry; 2D and 3D Transformations, Projections;  
3. Basic graphics modeling system, Graphics User Interface design, build your own GUI,  
4. [Mesh Representation] – most popular representation in computer graphics  
   - Representing objects using triangle meshes, Half-edge Data Structure;  
   - Computing geometric properties on triangle meshes (areas, curvature, geodesic curves)  
5. [Spatial-Partitioning Representation] – efficient Boolean (union, intersect) operations  
   - Representing objects using regular grids, Quad-tree (2D) and Oct-tree (3D);  
   - Efficient inter-object collision detection using hierarchical oct-tree  
6. [Parametric Representation] – industry CAD standard  
   - Representing objects using splines;  
   - Shape editing: Efficient free-form deformation  
7. [Medial Representation] – for gamers and animators  
   - Representing objects using its skeleton (skeletonization and mesh skinning)  
   - Skeleton-driven Animation  
8. Other representations and their applications;  
9. Selective graphics topics;

Homework and exams:

1. Four homework assignments (10+10+10+10);  
2. A course project (with a midterm and final presentation), you will pick the topic and team up for it (10+10+15);  
3. Final Exam (25).

Textbook: (not required, slides will be provided)  