

CS30800

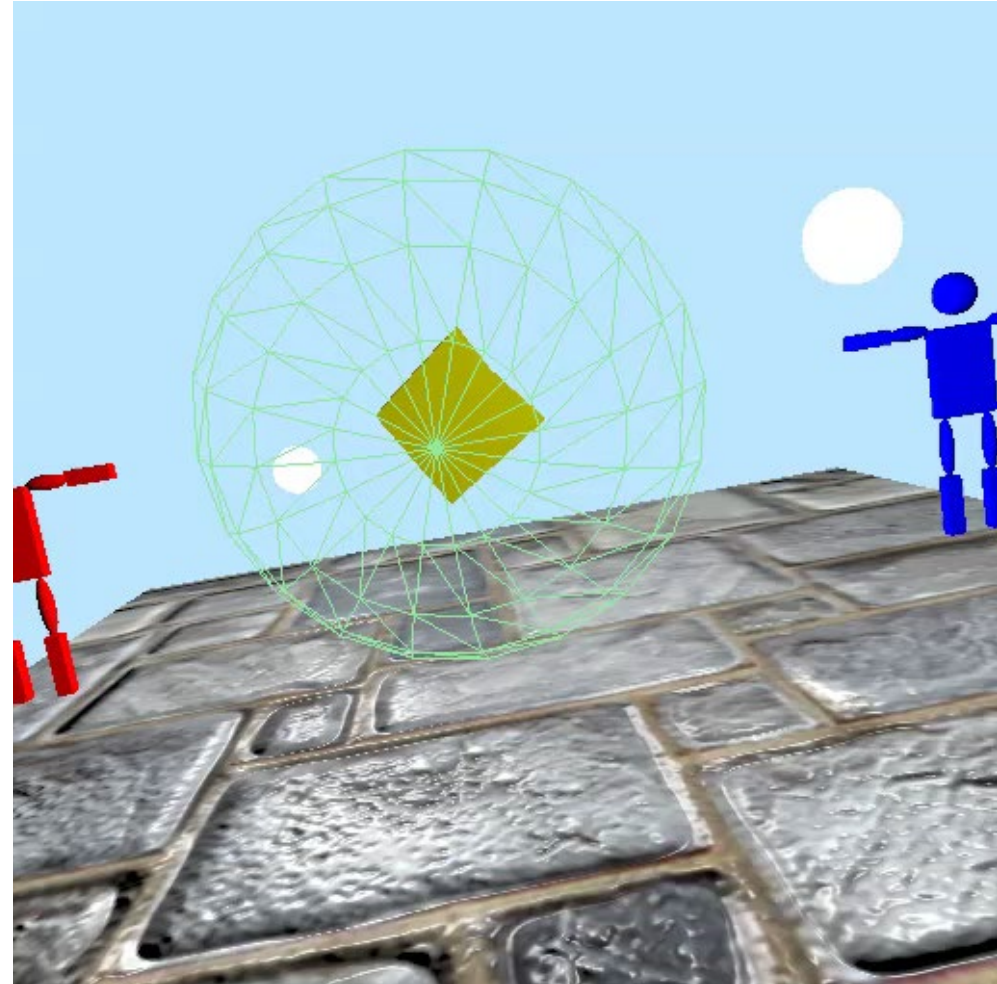
Introduction to Computer Graphics

Lab 9 – Meshes and Subdivision

2025. 05.27 / 2025. 05. 29



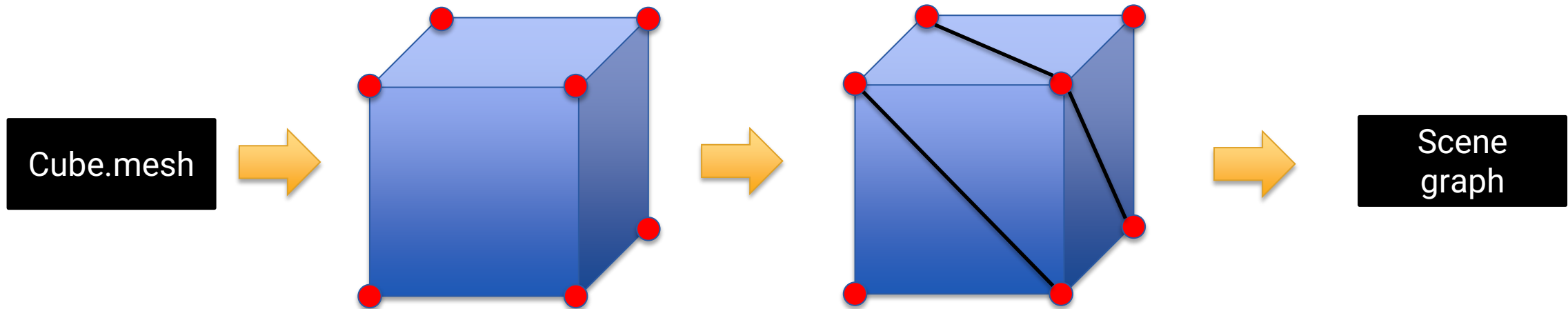
- In this session you learn mesh related things
 - Basic structure of mesh
 - Smooth shading
 - Sub-division of vertices
- Steps
 - Preparation
 - Task1: read a mesh file
 - Task2: smooth shading
 - Task3: animate the cube
 - Task4: sub-divide the cube



Task1: Mesh loading and construction



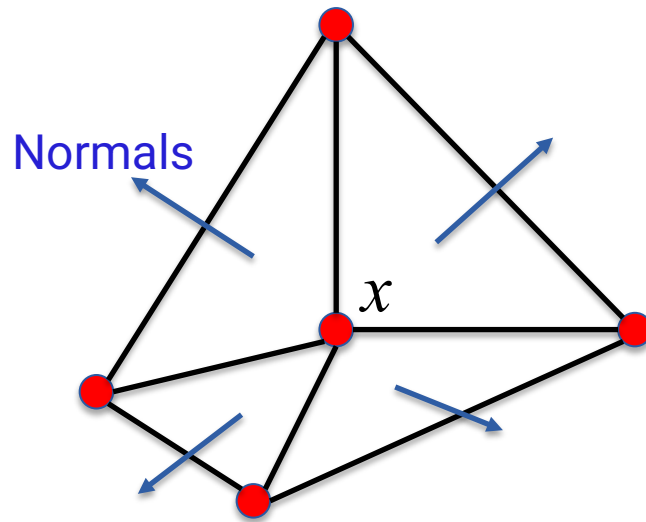
- Read the cube mesh (cube.mesh)
- Convert quad components to triangles
- Node is added to the scene graph



Task2: Shading



- Flat shading
 - A normal of a incident face is chosen
- Smooth shading
 - Average of normal of all incident face is chosen

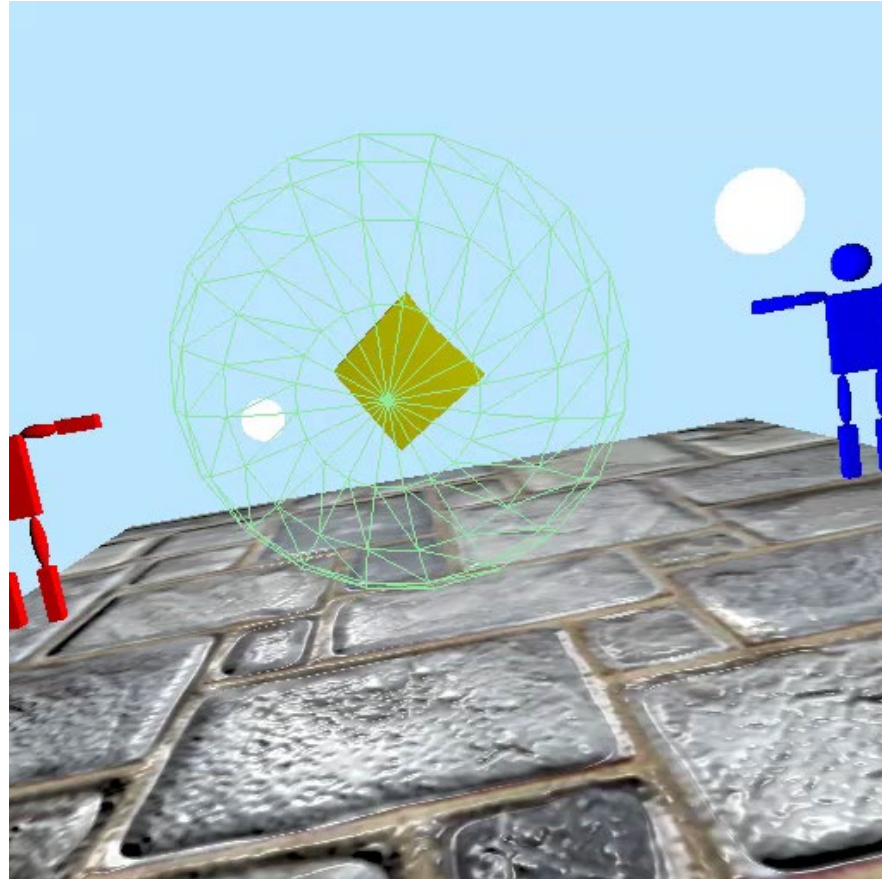
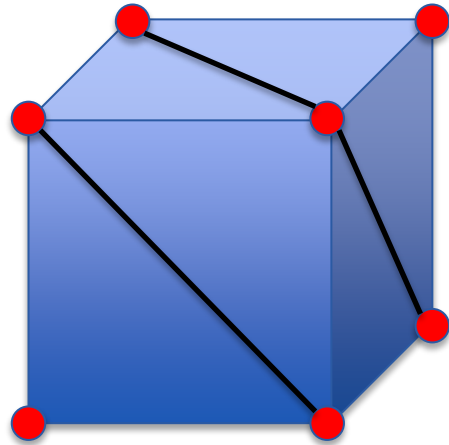


What is normal of x ?

Task3: Animation



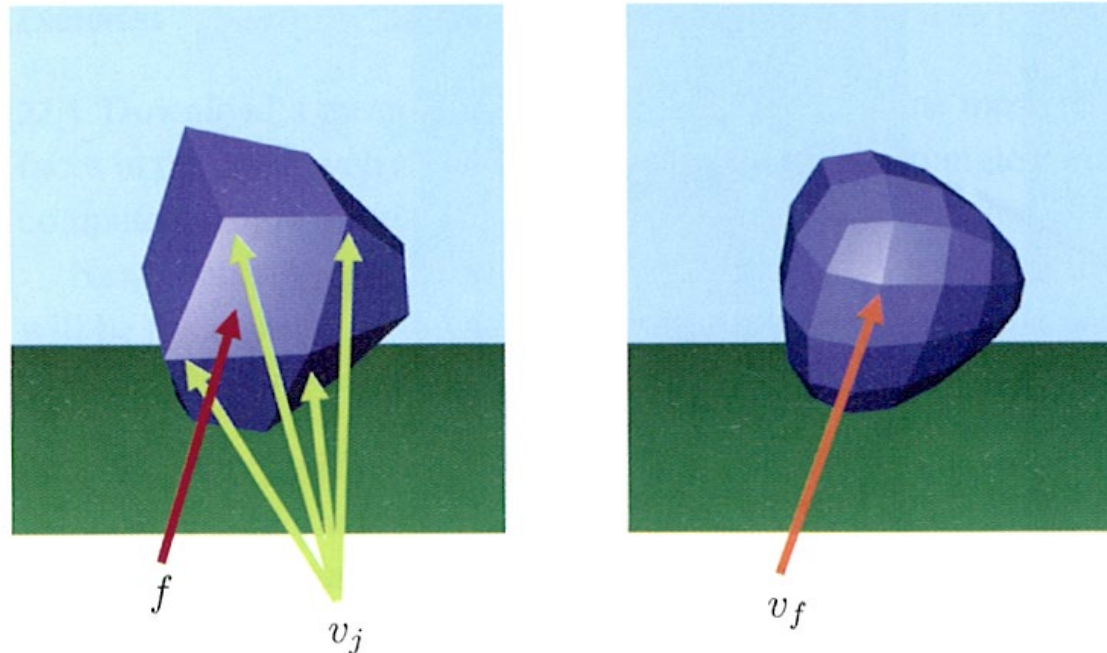
- A new call back for animating the vertices of the cube
 - GLUT timer callback



Task4: Subdivision



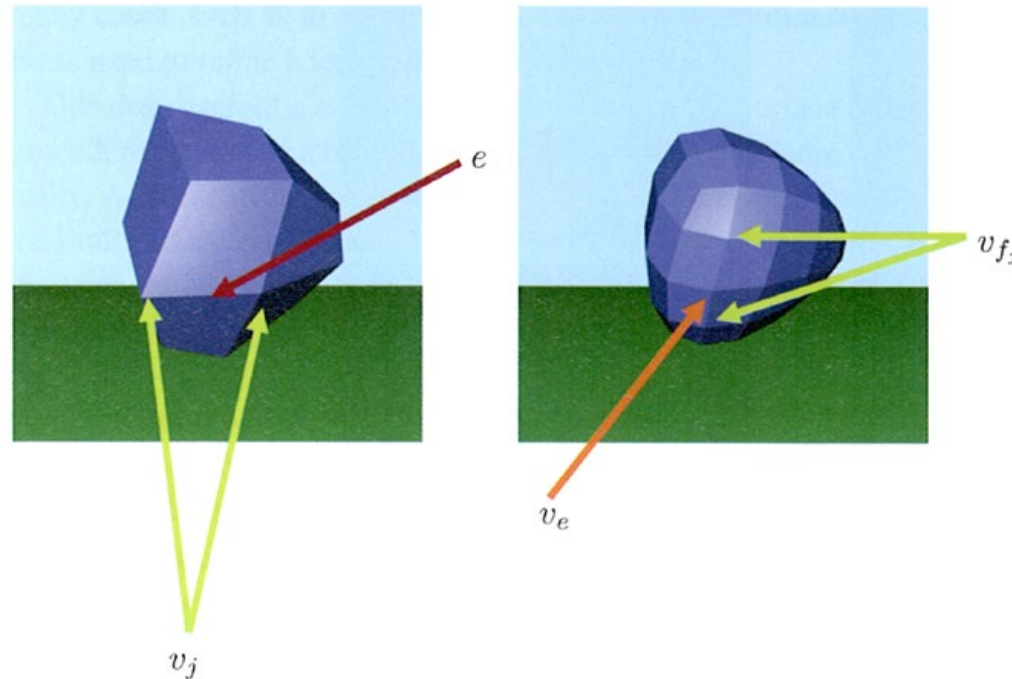
- Subdivision with Catmull-Clark algorithm
 - Starting from the watertight mesh M^0
 - Face-vertex $v_f = \frac{1}{m_f} \sum_j v_j$ (Centroid of the vertices)
 - Here, m_f is the number of the vertices



Task4: Subdivision



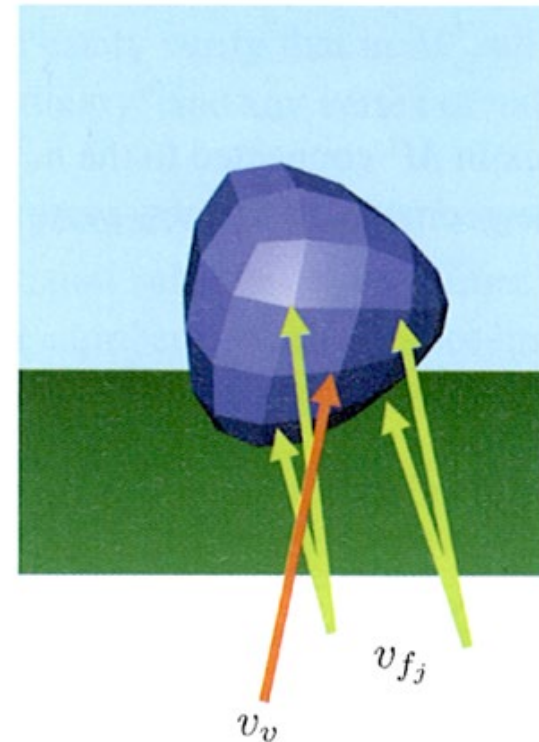
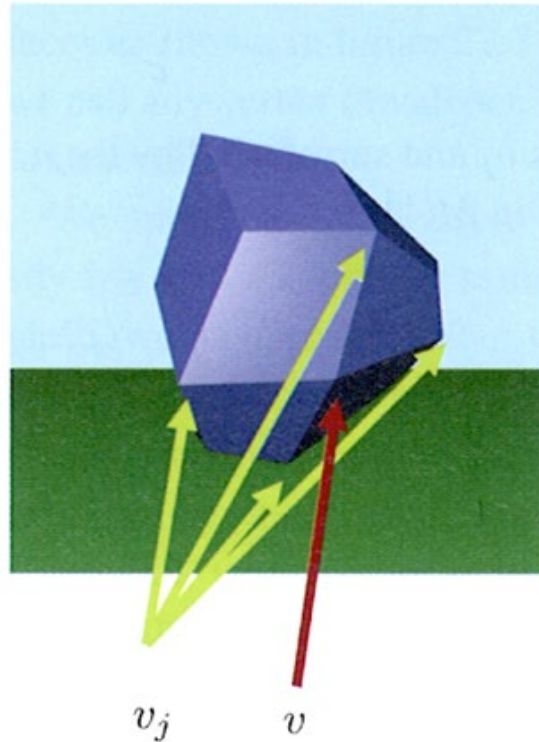
- Subdivision with Catmull-Clark algorithm
 - Constructed from the two vertices of the edge,
 - And the two newly created vertices of the two incident faces
 - Edge-vertex $v_e = \frac{1}{4}(v_1 + v_2 + v_{f_1} + v_{f_2})$



Task4: Subdivision



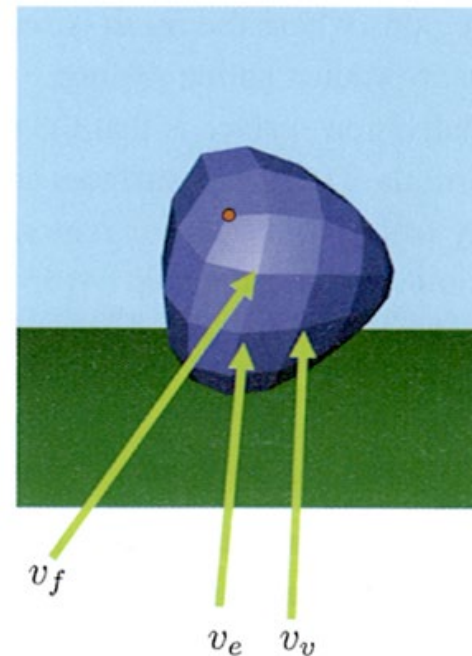
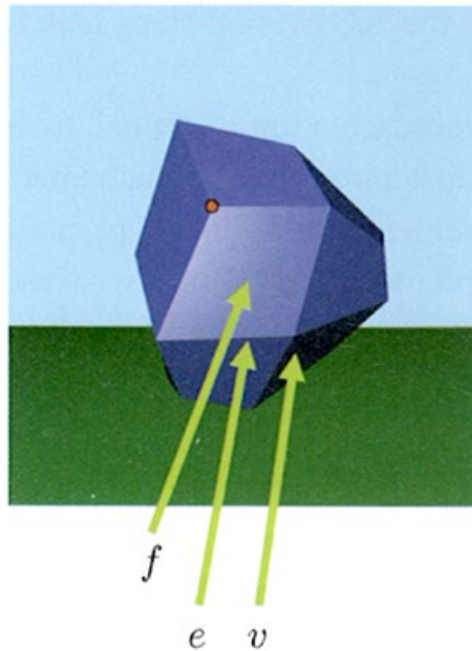
- Subdivision with Catmull-Clark algorithm
 - Vertex-vertex $v_v = \frac{n_v - 2}{n_v} v + \frac{1}{n_v^2} \sum_j v_j + \frac{1}{n_v^2} \sum_j v_{f_j}$



Task4: Subdivision



- Overall construction
 - Face-vertex $v_f = \frac{1}{m_f} \sum_j v_j$
 - Edge-vertex $v_e = \frac{1}{4} (v_1 + v_2 + v_{f_1} + v_{f_2})$
 - Vertex-vertex $v_v = \frac{n_v - 2}{n_v} v + \frac{1}{n_v^2} \sum_j v_j + \frac{1}{n_v^2} \sum_j v_{f_j}$



Question?