

Tessellation Shader

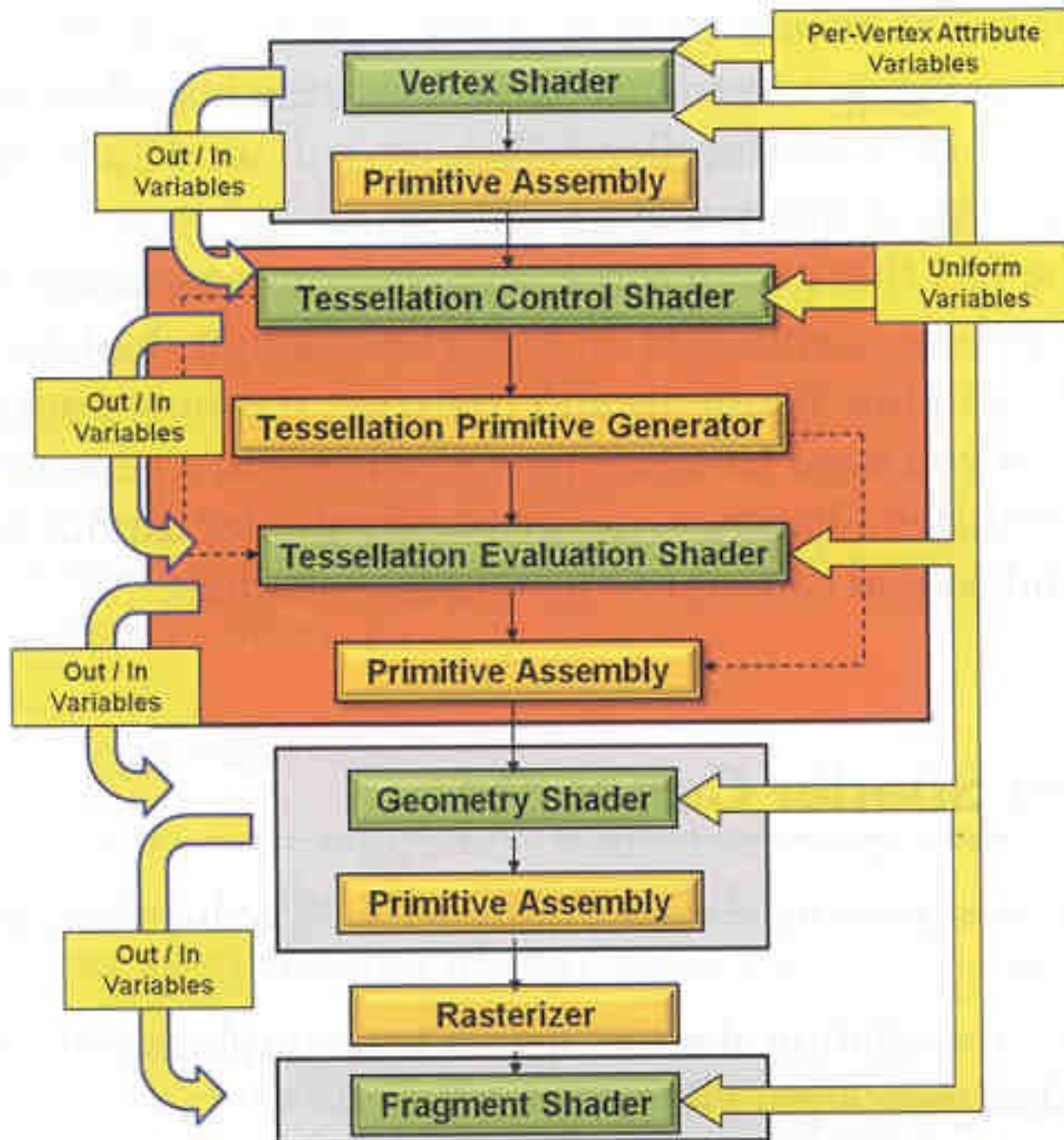
CSCI 4239/5239

**Advanced Computer Graphics
Spring 2025**

What is it?

- Allows dynamic refinement of objects
- Subdivides lines, triangles or quads
- Inserted between vertex shader and geometry shader
- Special Type: `GL_PATCHES`
- Best resource
 - Graphics Shaders: Theory and Practice (2e)
 - Bailey and Cunningham
 - Chapter 12

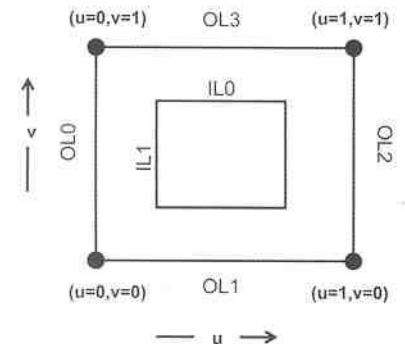
Where does it fit?



Coordinates

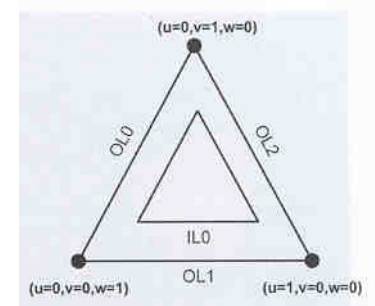
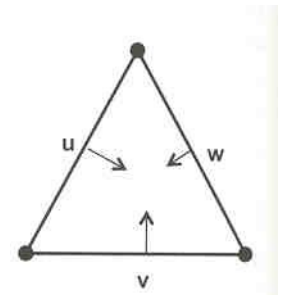
- Quads

- Cartesian coordinates
- Two outer division levels
- Two inner division levels



- Triangles

- Barycentric coordinates
- Three outer division levels
- One inner division level



OpenGL Implementation

- Requires OpenGL 4.0
- Create and compile just like others
 - `glCreateShader(GL_TESS_CONTROL_SHADER)`
 - `glCreateShader(GL_TESS_EVALUATION_SHADER)`
- Requires additional parameters
 - In program
 - `glPatchParameter*()`
 - In shader
 - `layout()`

GLSL Implementation

- Tessellation Control
 - Set position
 - Set inner level
 - Set outer level
- Tessellation Evaluation
 - Interpolate in cartesian/barycentric coordinates
 - Set vertex `gl_Position`
- Geometry
 - Expand to triangle strip

Ex 19: Geodesic Tessellation

- Approximates sphere by subdividing geodesic icosahedron
 - 12 vertices
 - 20 triangles
- Collection of all shaders
 - Vertex Shader
 - Tessellation Control Shader
 - Tessellation Evaluation Shader
 - Geometry Shader
 - Fragment Shader