

# **Tessellation Shader**

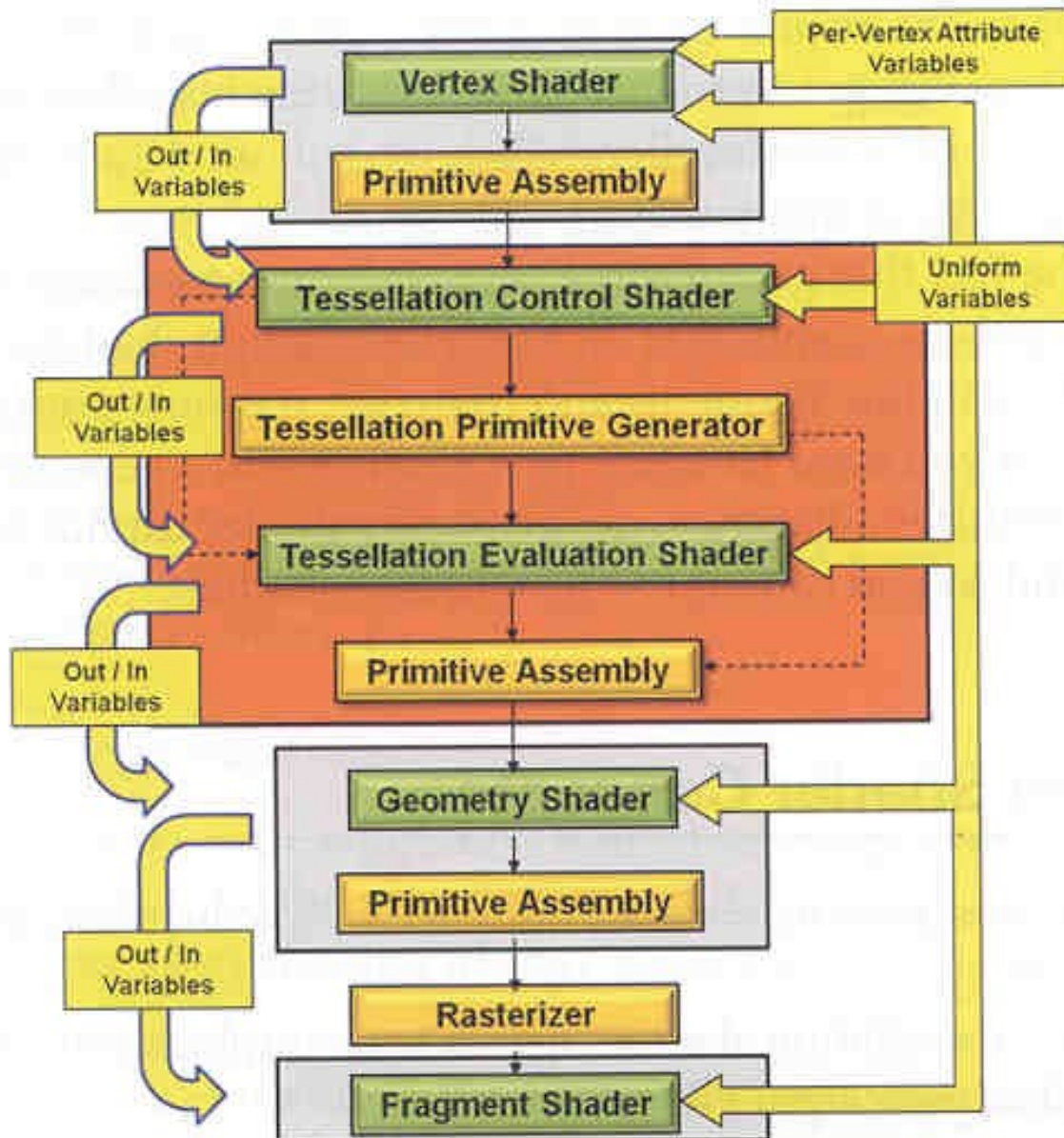
**CSCI 4239/5239**

**Advanced Computer Graphics  
Spring 2023**

# 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

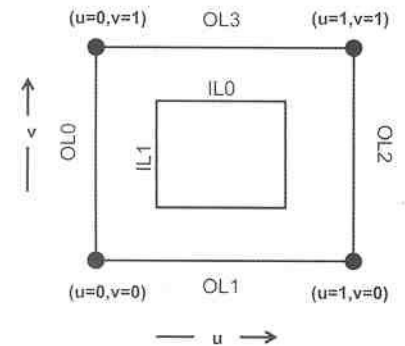
# Where does it fit?



# Coordinates

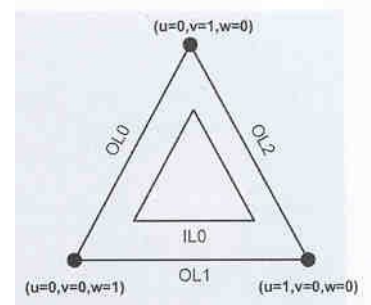
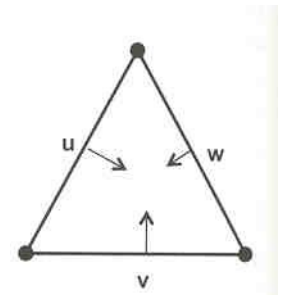
- Quads

- 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 18: 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