

Geometry Shader

CSCI 4239/5239

Advanced Computer Graphics

Spring 2025

What is it?

- Create new primitives
 - Point → Polygon
- Inserted between vertex shader and fragment shader
- Changes each `gl_Vertex` into multiple vertexes

OpenGL Implementation

- Create and compile just like others
 - `glCreateShader(GL_GEOMETRY_SHADER)`
- Requires additional parameters
 - In the program (OpenGL 3.2)
 - `glProgramParameteri(prog,par,val);`
 - `GL_GEOMETRY_INPUT_TYPE`
 - `GL_GEOMETRY_OUTPUT_TYPE`
 - `GL_GEOMETRY_VERTICES_OUT`
 - In the shader (OpenGL 3.3)
 - `layout(type) in;`
 - `layout(type,max_vertices=n) out;`

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GLSL Implementation

- Set vertex parameters like in vertex shader
 - out Color
 - out Tex2D
 - gl_Position
- Call `EmitVertex()`; when done
- Call `EndPrimitive()`; after last vertex

Application: n-Body Problem

- Movement of n bodies under gravitational influence
- Classical problem in computational dynamics
- Hard because effort grows as n^2
- Display locations of bodies

Digression: OpenMP

- Multi-threaded approach
 - Lightweight
 - Needs shared memory
- API supported in C/C++ using pragmas

```
#pragma omp parallel for
for (k=0;k<N;k++)
    foo(k);
```
- Simple to use
- Needs compiler support
 - gcc -fopenmp

Ex 18: OpenMP+Geometry Shader

- Solve n-Body problem using OpenMP
 - Euler integration
 - Ping-Pong implementation
- Use geometry shader to turn points into a quad and billboard
 - Apply texture to point
 - Blend to add
- Example of a particle shader

