Geometry Shader

CSCI 4239/5239
Advanced Computer Graphics
Spring 2021

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;
-

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 17: 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