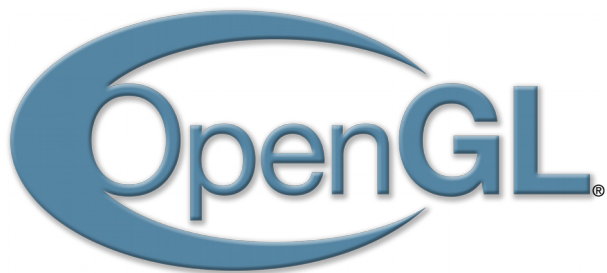




OpenGL

Изграждане на
Геометрични обекти



гл. ас. д-р А. Пенев

Изчистване на Изображението (1/3)

```
void glClear(GLbitfield mask)
```

mask :

GL_COLOR_BUFFER_BIT

на Цвета

GL_DEPTH_BUFFER_BIT

на Дълбочината

GL_ACCUM_BUFFER_BIT

на Натрупване

GL_STENCIL_BUFFER_BIT

на Маската

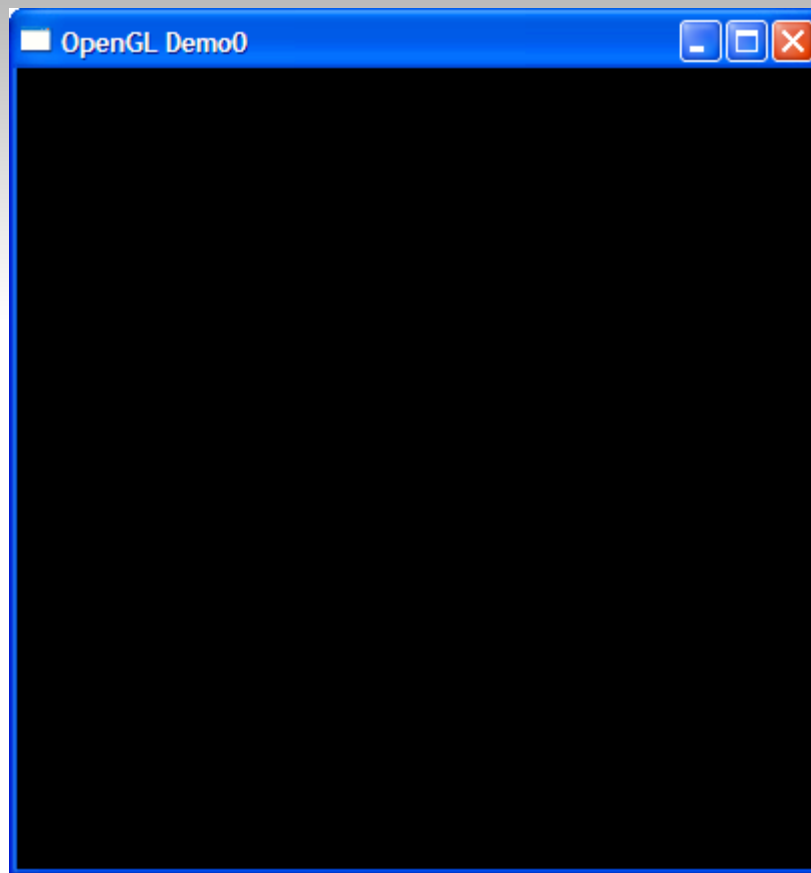
Изчистване на Изображението (2/3)

```
void glClearColor(GLclampf red,  
                 GLclampf green, GLclampf blue,  
                 GLclampf alpha)
```

Пример :

```
glClearColor(0,0,0,0);  
glClear(GL_COLOR_BUFFER_BIT |  
        GL_DEPTH_BUFFER_BIT);
```

Изчистване на Изображението (3/3)



Повече в лекцията за Работа с Буфери...

glFlush и glFinish

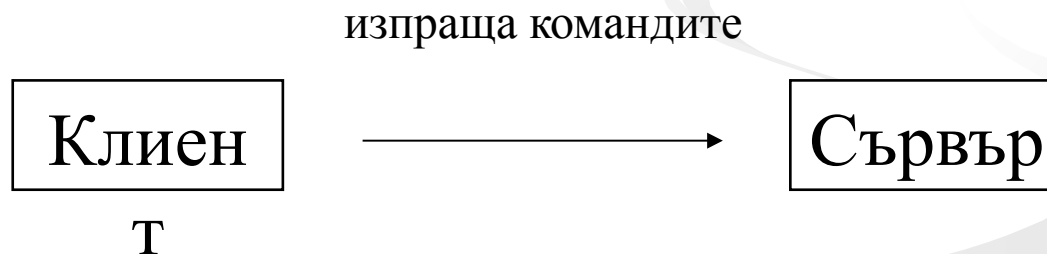
```
void glFlush(void)
```

```
void glFinish(void)
```

```
void glutSwapBuffers(void)
```

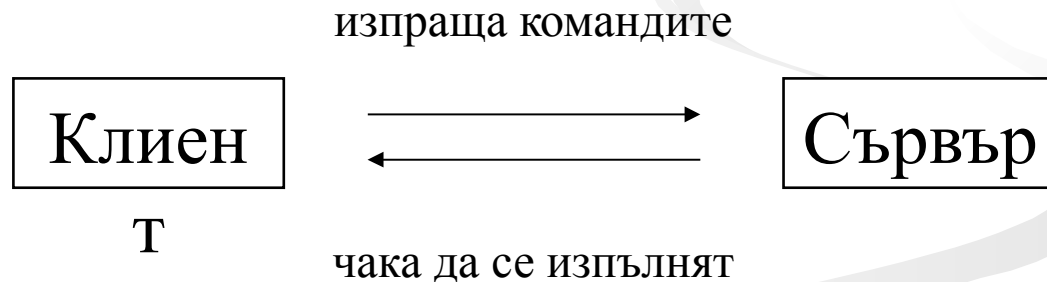
glFlush

```
glClearColor(0,0,0,0);  
glClear(GL_COLOR_BUFFER_BIT);  
...  
glFlush();
```



glFinish

```
glClearColor(0, 0, 0, 0);  
glClear(GL_COLOR_BUFFER_BIT);  
...  
glFinish();
```



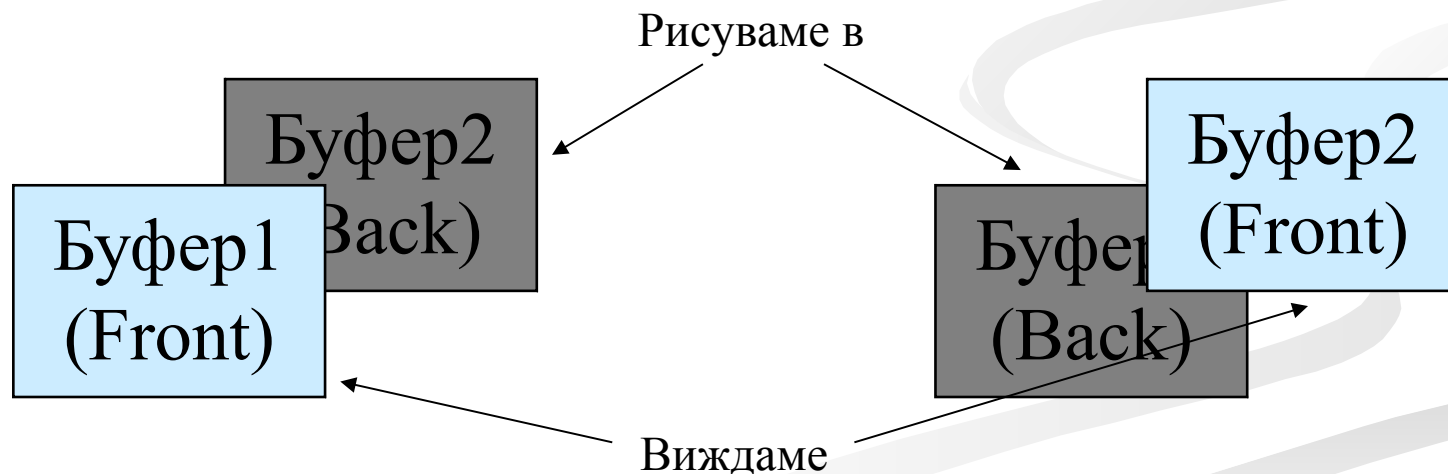
glutSwapBuffers

```
glClearColor(0,0,0,0);
```

```
glClear(GL_COLOR_BUFFER_BIT);
```

...

```
glutSwapBuffers(); //извършва и Flush
```



glVertex

Основна команда за дефиниране на
геометрията на сцената

```
void glVertex... (x, y, z, w)
```

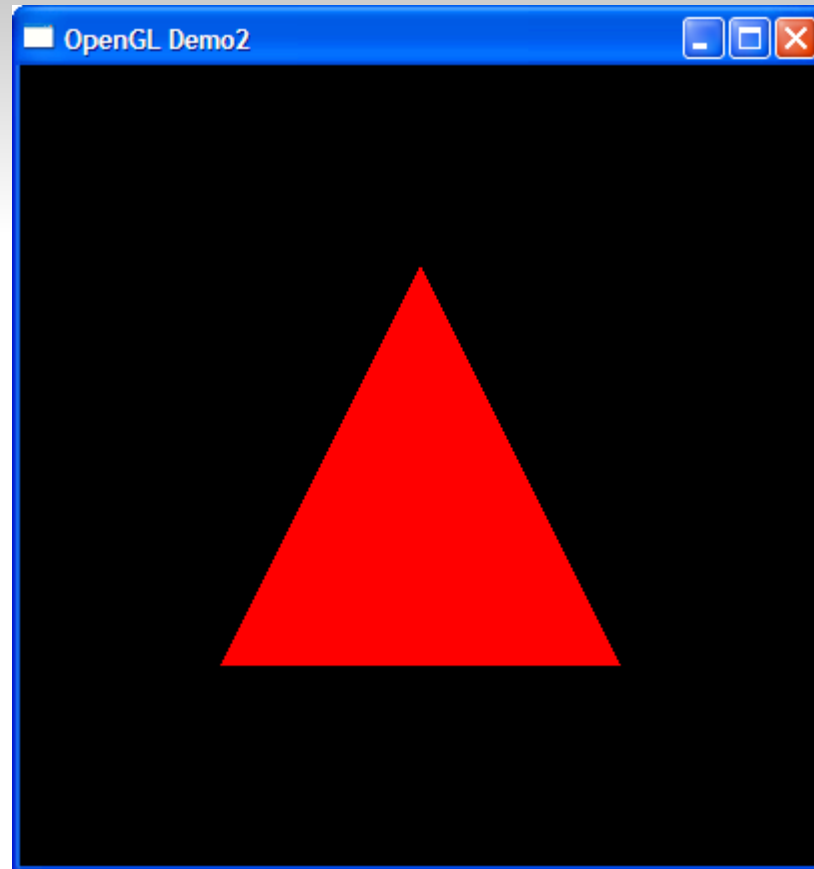
“Рисуване”

```
void glBegin(GLenum mode)  
void glEnd(void)
```

Пример:

```
glColor3d(1, 0, 0);  
glBegin(GL_TRIANGLES);  
    glVertex2d(-1.0, -1.0);  
    glVertex2d(1.0, -1.0);  
    glVertex2d(0.0, 1.0);  
glEnd();
```

Пример 1



glBegin режими

GL_POINTS

Точки

GL_LINES

Отсечки

GL_LINE_STRIP

Начупена линия

GL_LINE_LOOP

Затворена начупена линия

GL_TRIANGLES

Триъгълници

GL_TRIANGLE_STRIP

Ивица от триъгълници

GL_TRIANGLE_FAN

Ветрило от триъгълници

GL_QUADS

Четириъгълници

GL_QUAD_STRIP

Ивица от четириъгълници

GL_POLYGON

Многоъгълник

GL_POINTS

● V0

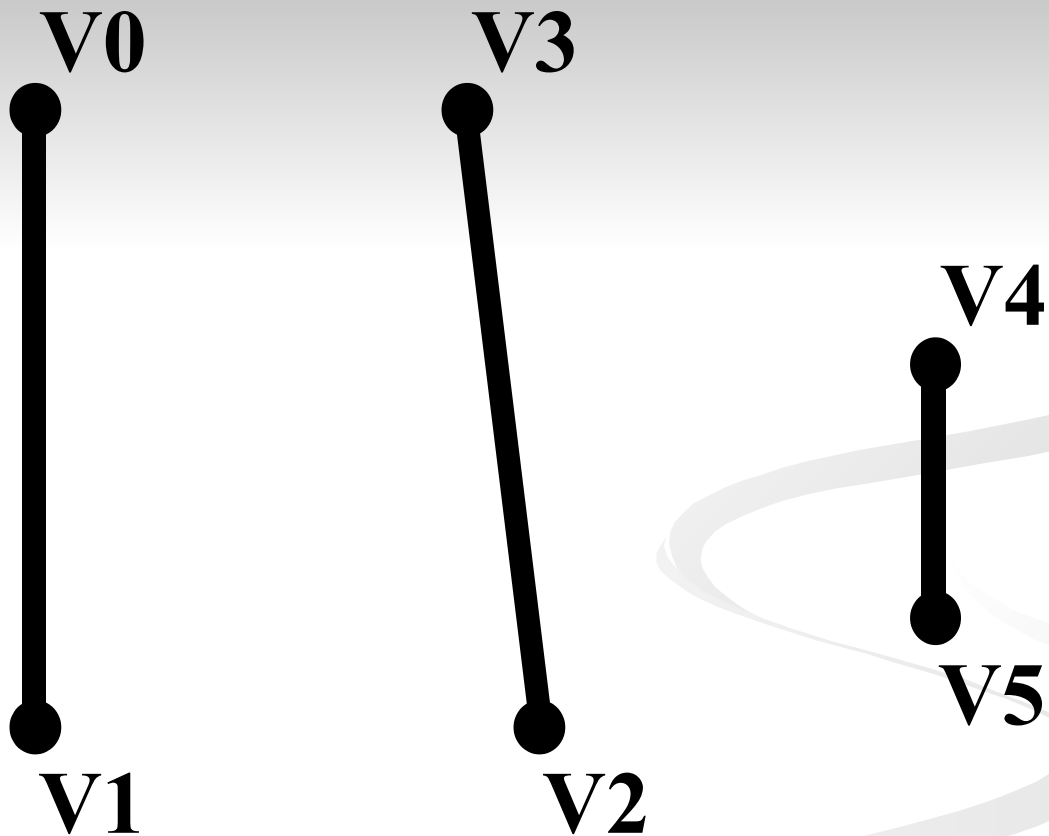
● V3

● V4

● V1

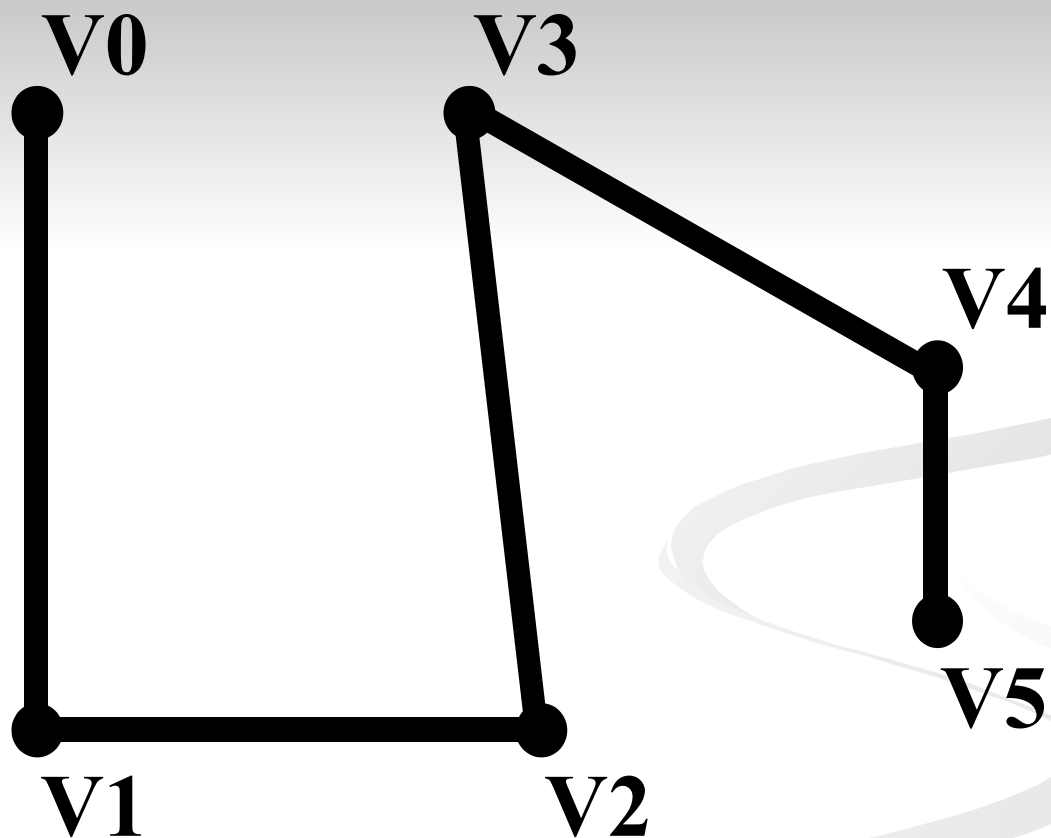
● V2

GL_LINES



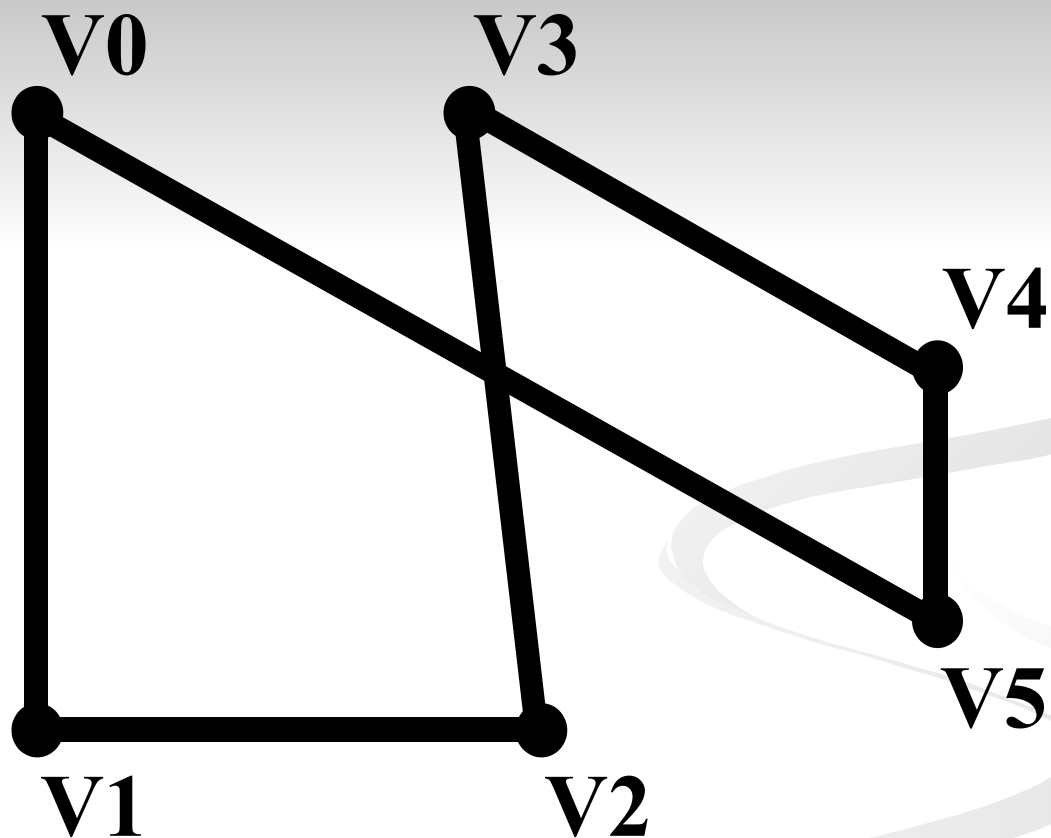
Забележка: Точките не се визуализират

GL_LINE_STRIP



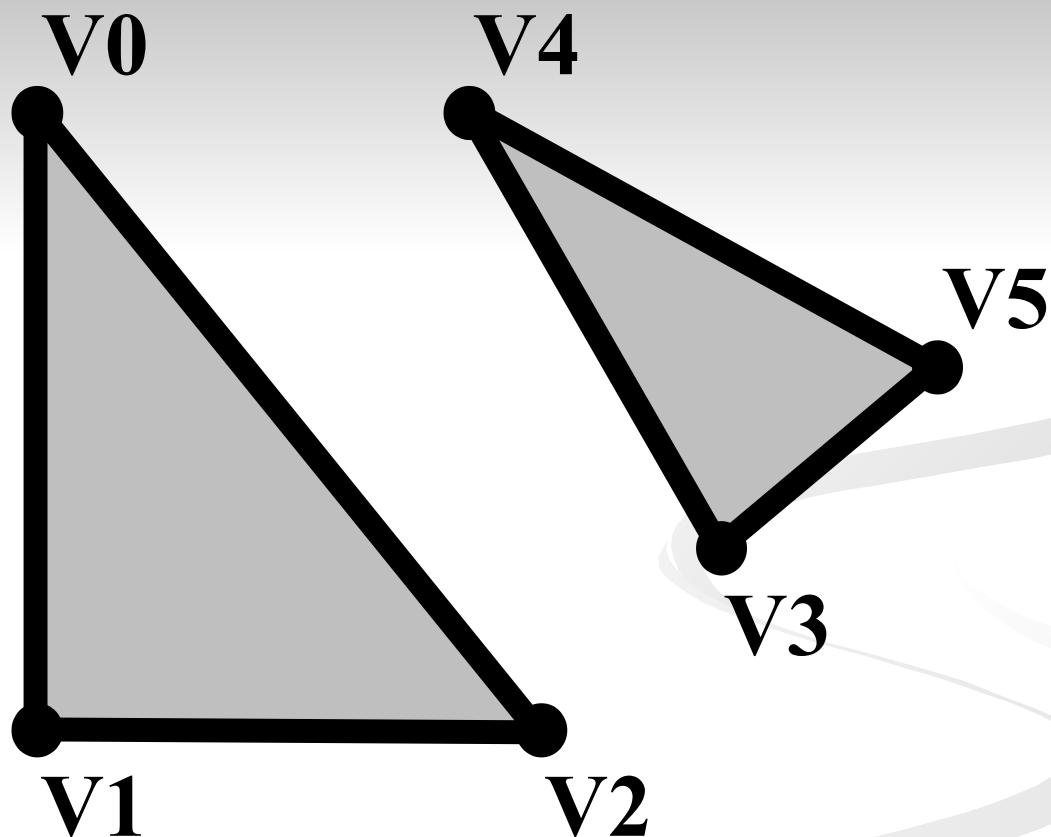
Забележка: Точките не се визуализират

GL_LINE_LOOP



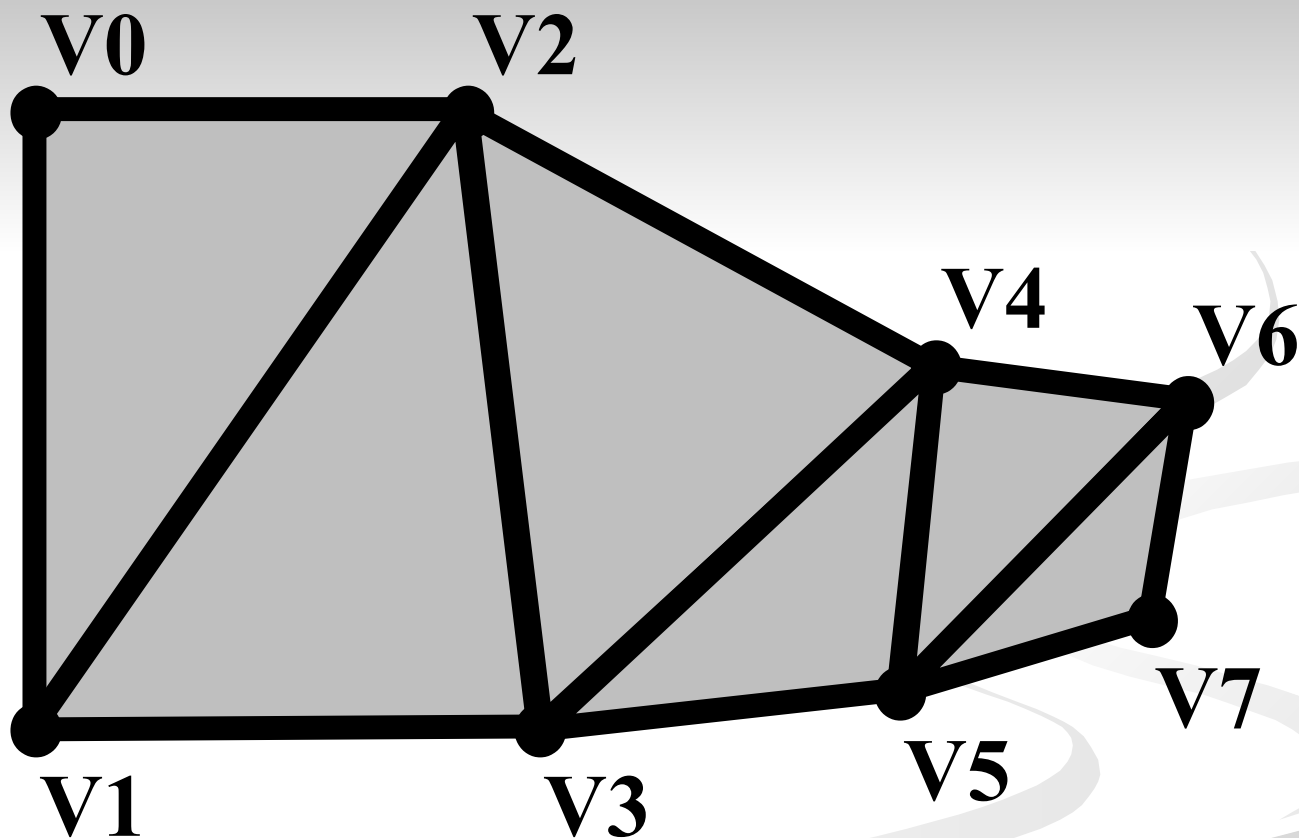
Забележка: Точките не се визуализират

GL_TRIANGLES



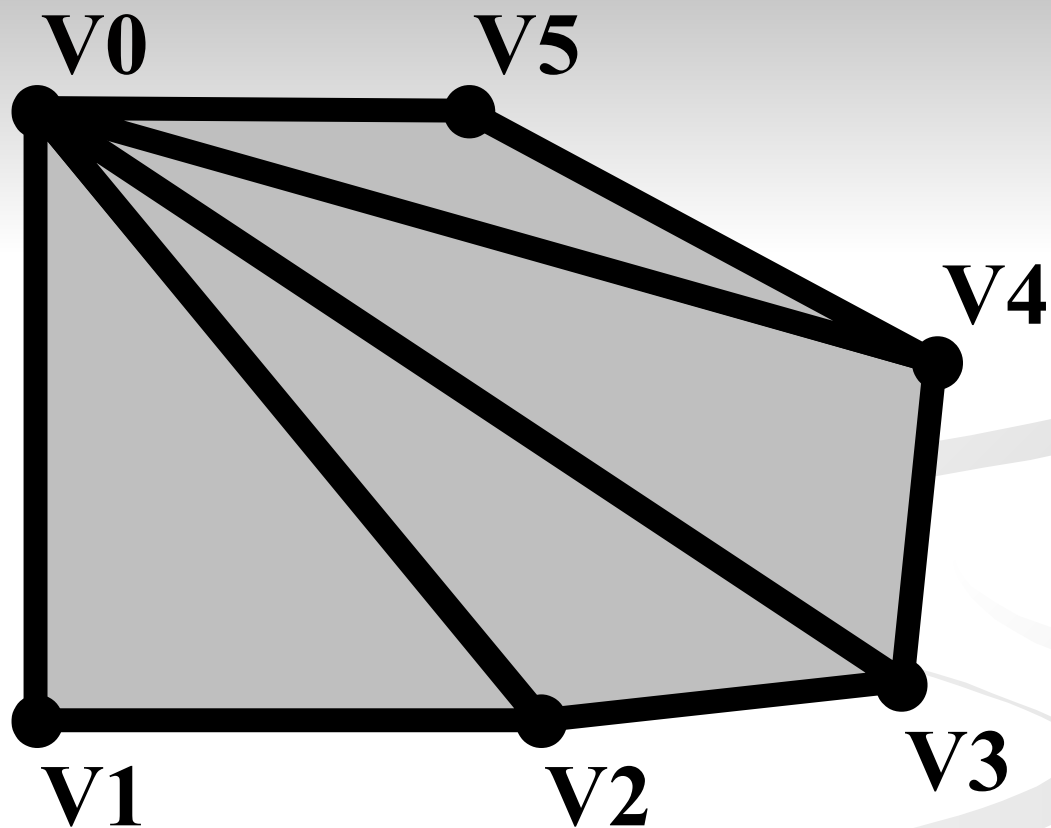
Забележка: Точките и линиите не се визуализират

GL_TRIANGLE_STRIP



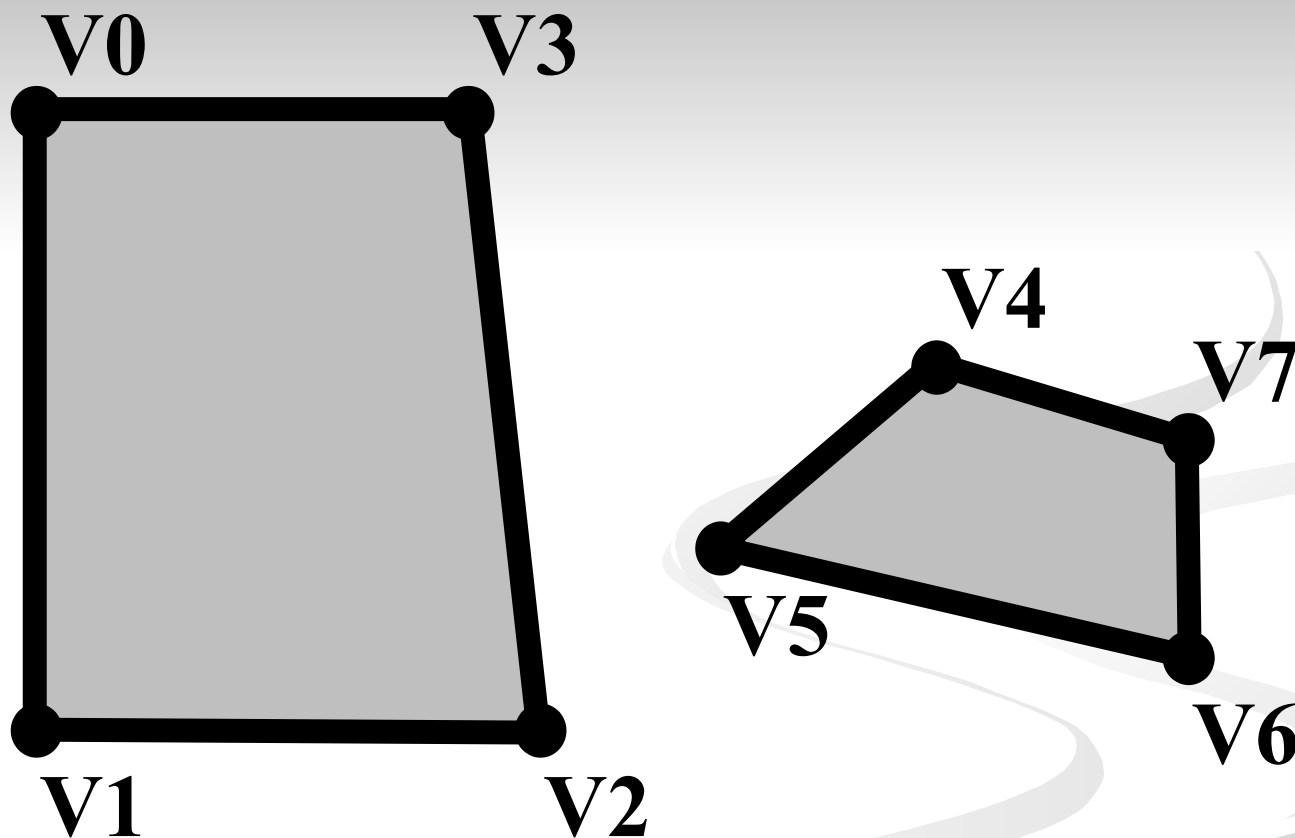
Забележка: Точките и линиите не се визуализират

GL_TRIANGLE_FAN



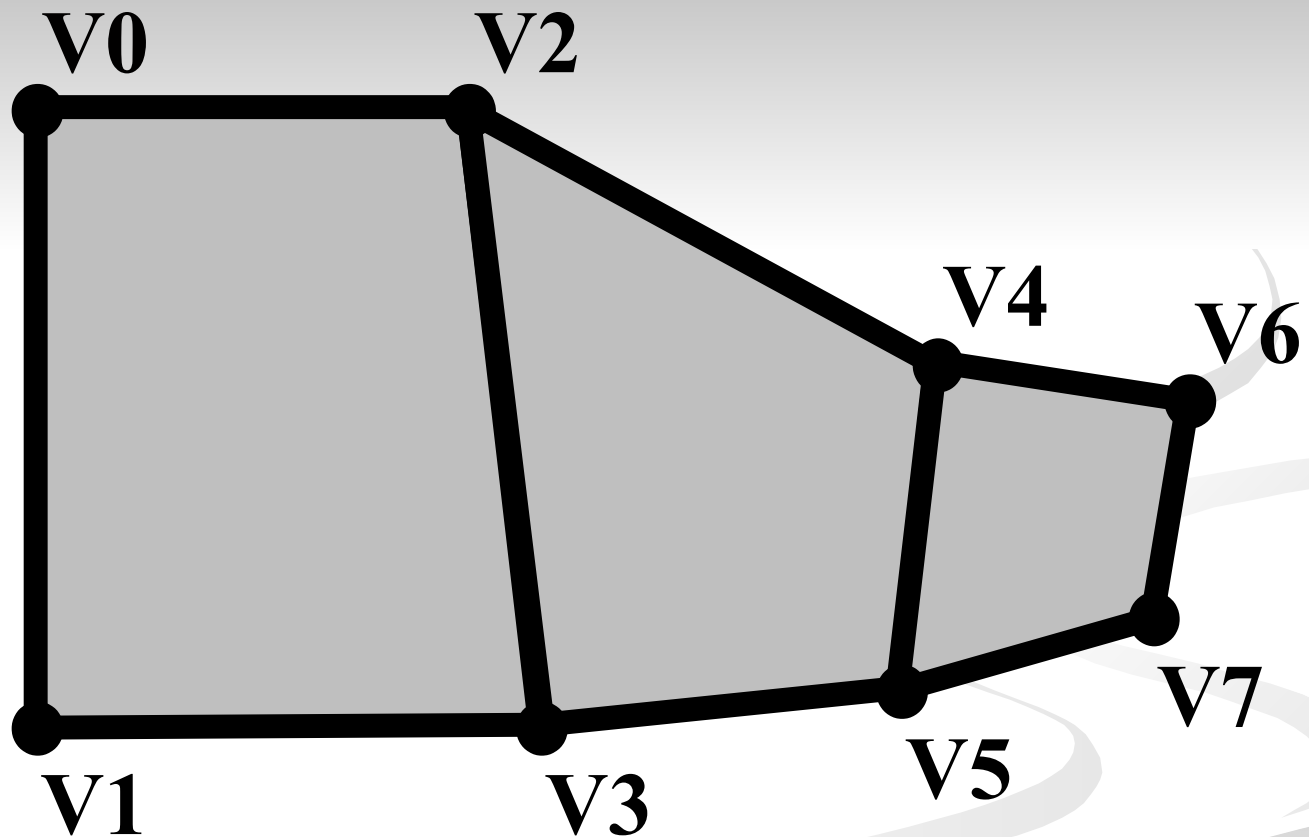
Забележка: Точките и линиите не се визуализират

GL_QUADS



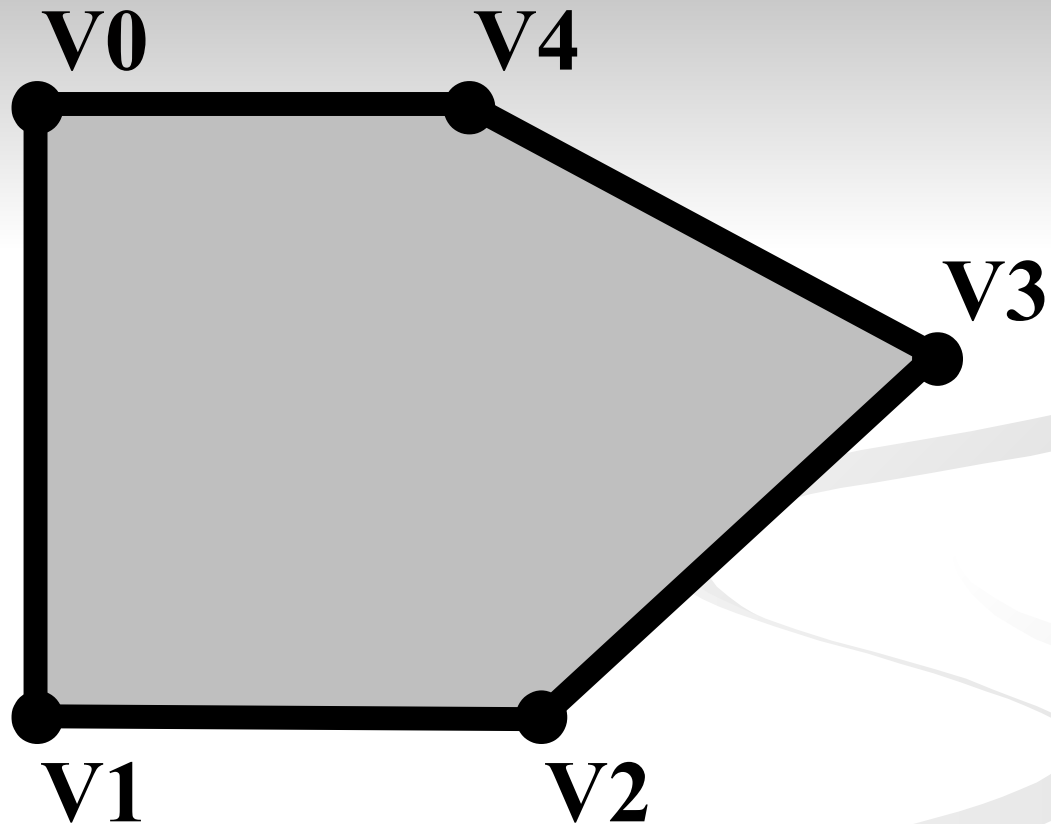
Забележка: Точките и линиите не се визуализират

GL_QUAD_STRIP



Забележка: Точките и линиите не се визуализират

GL_POLYGON

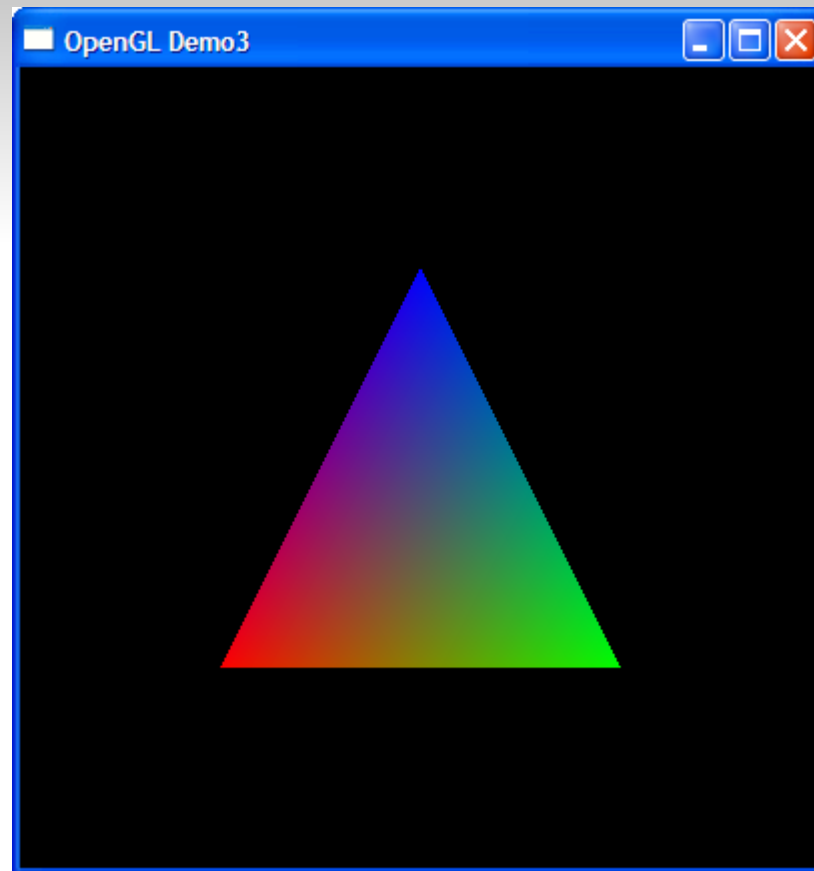


Забележка: Точките и линиите не се визуализират

Характеристики на Връх

```
glBegin (GL_TRIANGLES) ;  
    glColor3d (1, 0, 0) ;  
    glVertex2d (-1.0, -1.0) ;  
    glColor3d (0, 1, 0) ;  
    glVertex2d (1.0, -1.0) ;  
    glColor3d (0, 0, 1) ;  
    glVertex2d (0.0, 1.0) ;  
glEnd () ;
```

Пример 2



Характеристики на връх

```
void glColor... (red, green, blue, a)  
void glIndex... (color_index)  
void glNormal3... (nx, ny, nz)
```

... и много други, които няма да разглеждаме сега.

Точки

```
void glPointSize(GLfloat size)
```

```
glGetFloatv(GL_POINT_SIZE, &s);
```

```
glGetFloatv(GL_POINT_SIZE_RANGE, &s);
```

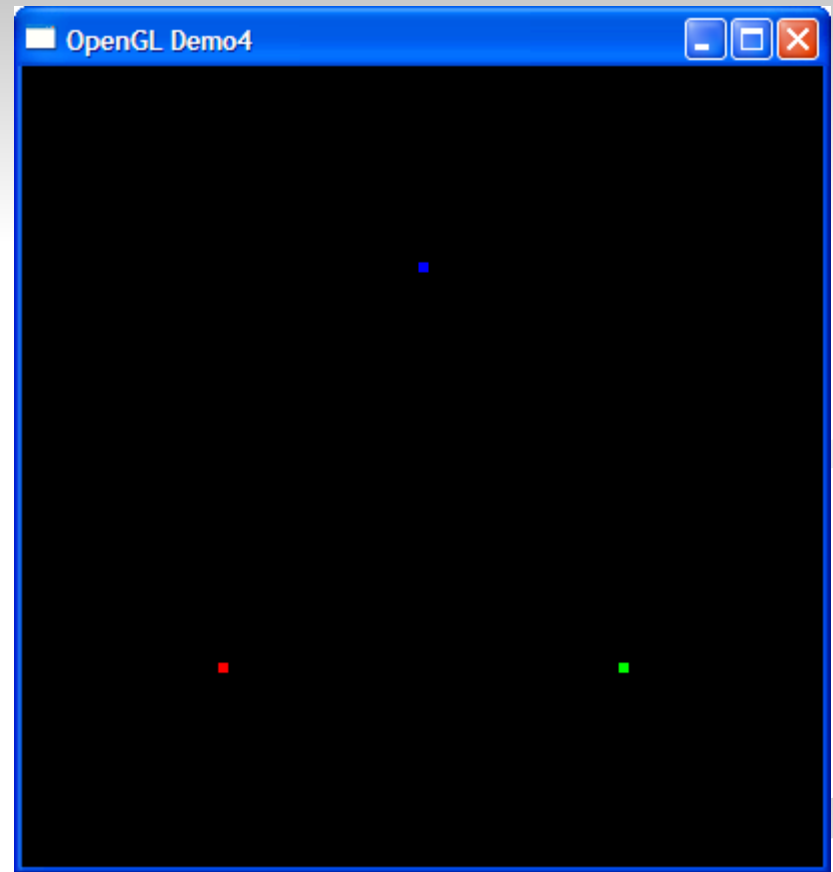
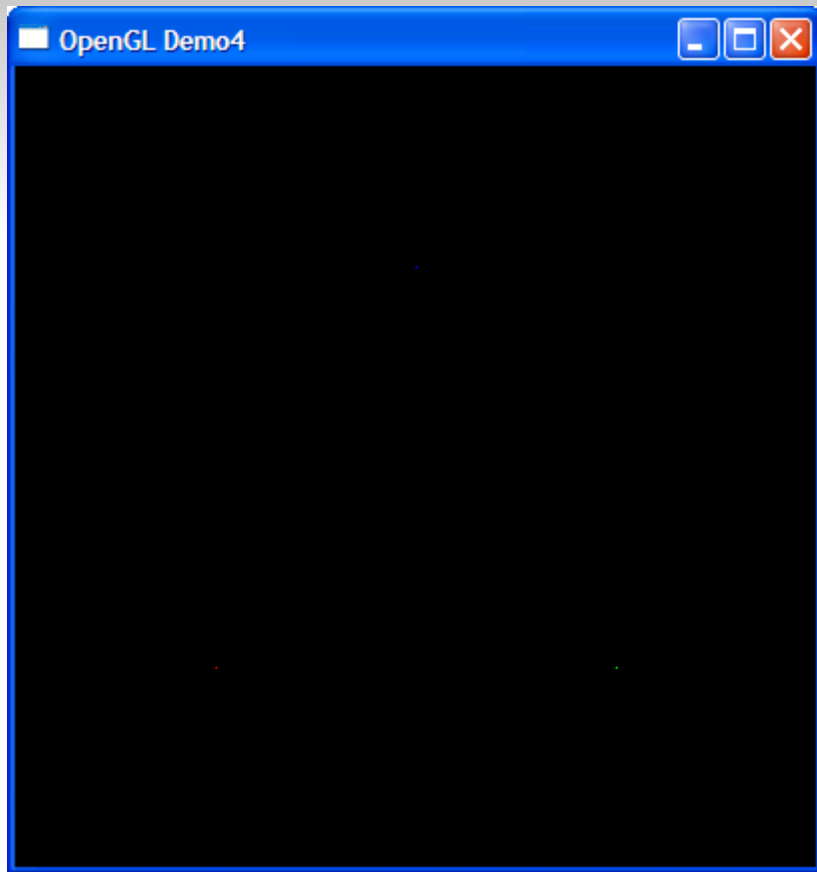
```
glEnable(GL_POINT_SMOOTH);
```

```
glDisable(GL_POINT_SMOOTH);
```

Пример 3 (1/2)

```
glPointSize (5) ;  
glBegin (GL_POINTS) ;  
    glColor3d (1, 0, 0) ;  
    glVertex2d (-1.0, -1.0) ;  
    glColor3d (0, 1, 0) ;  
    glVertex2d (1.0, -1.0) ;  
    glColor3d (0, 0, 1) ;  
    glVertex2d (0.0, 1.0) ;  
glEnd () ;
```

Пример 3 (2/2)



Линии

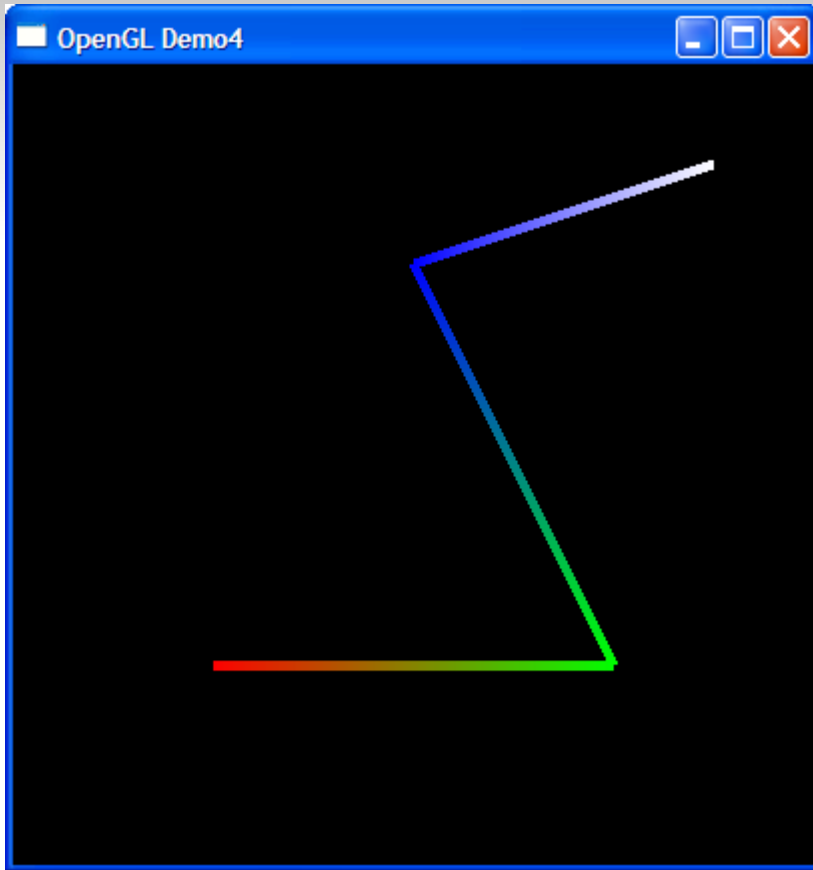
```
void glLineWidth(GLfloat width)  
void glLineStipple(GLint factor,  
GLushort pattern)
```

```
glGetFloatv(GL_LINE_WIDTH, &w);  
glGetFloatv(GL_LINE_WIDTH_RANGE, &w);  
glEnable(GL_LINE_STIPPLE);  
glEnable(GL_LINE_SMOOTH);  
glDisable(GL_LINE_SMOOTH);
```

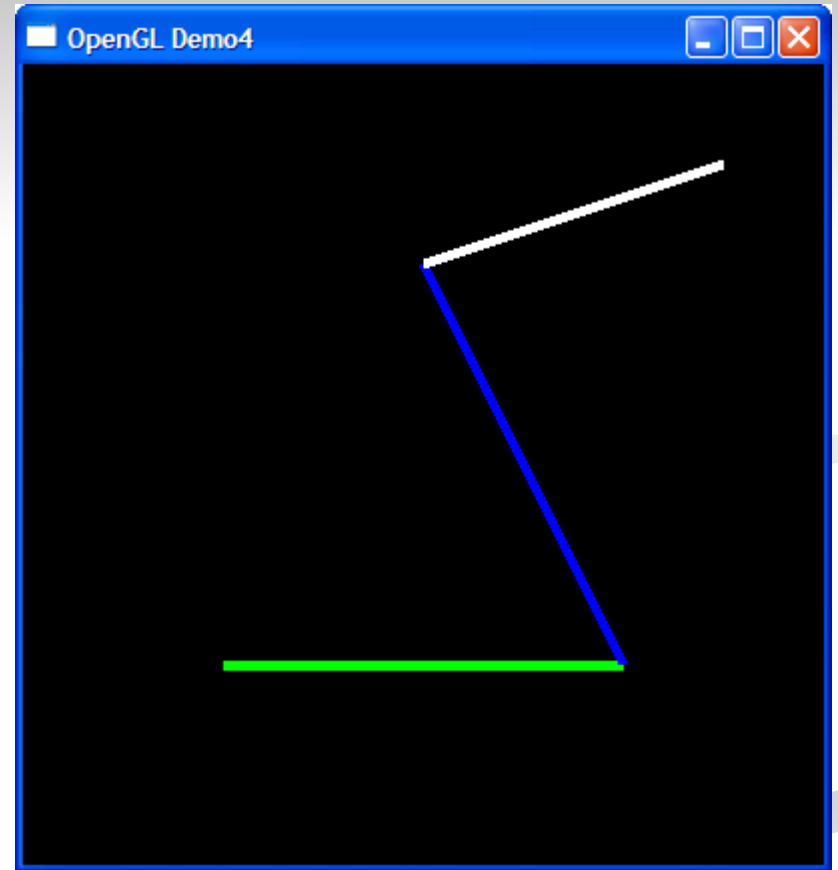
Пример 4 (1/2)

```
glShadeModel (GL_FLAT) ;  
glLineWidth (5) ;  
glBegin (GL_LINE_STRIP) ;  
    glColor3d (1, 0, 0) ;  
    glVertex2d (-1.0, -1.0) ;  
    glColor3d (0, 1, 0) ;  
    glVertex2d (1.0, -1.0) ;  
    glColor3d (0, 0, 1) ;  
    glVertex2d (0.0, 1.0) ;  
    glColor3d (1, 1, 1) ;  
    glVertex2d (1.5, 1.5) ;  
glEnd () ;
```

Пример 4 (2/2)



`glShadeModel(GL_SMOOTH)`

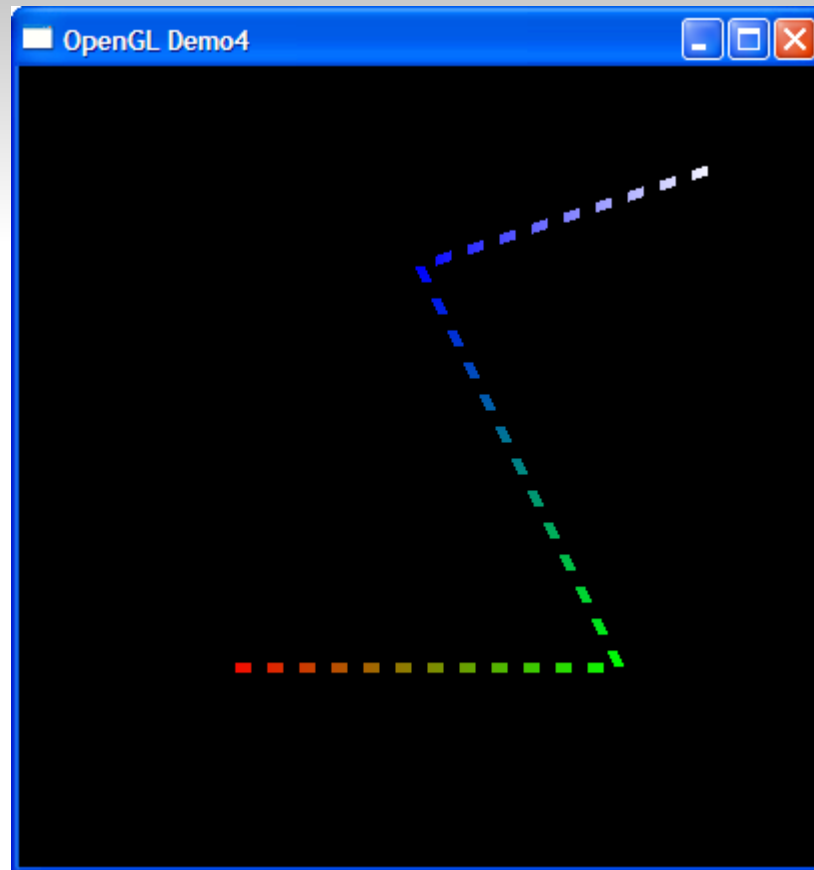


`glShadeModel(GL_FLAT)`

Пример 5 (1/2)

```
glEnable(GL_LINE_STIPPLE);  
glLineStipple(1, 0xFF00);  
glLineWidth(5);  
glBegin(GL_LINE_STRIP);  
    glColor3d(1,0,0);  
    glVertex2d(-1.0, -1.0);  
    glColor3d(0,1,0);  
    glVertex2d(1.0, -1.0);  
    glColor3d(0,0,1);  
    glVertex2d(0.0, 1.0);  
    glColor3d(1,1,1);  
    glVertex2d(1.5, 1.5);  
glEnd();
```


Пример 5 (2/2)



Многоъгълници

```
void glPolygonMode(GLenum face, GLenum mode)
```

face:

GL_FRONT

само за предна страна

GL_BACK

само за задна страна

GL_FRONT_AND_BACK

и за двете страни

mode:

GL_POINT

само върхове

GL_LINE

само ребра

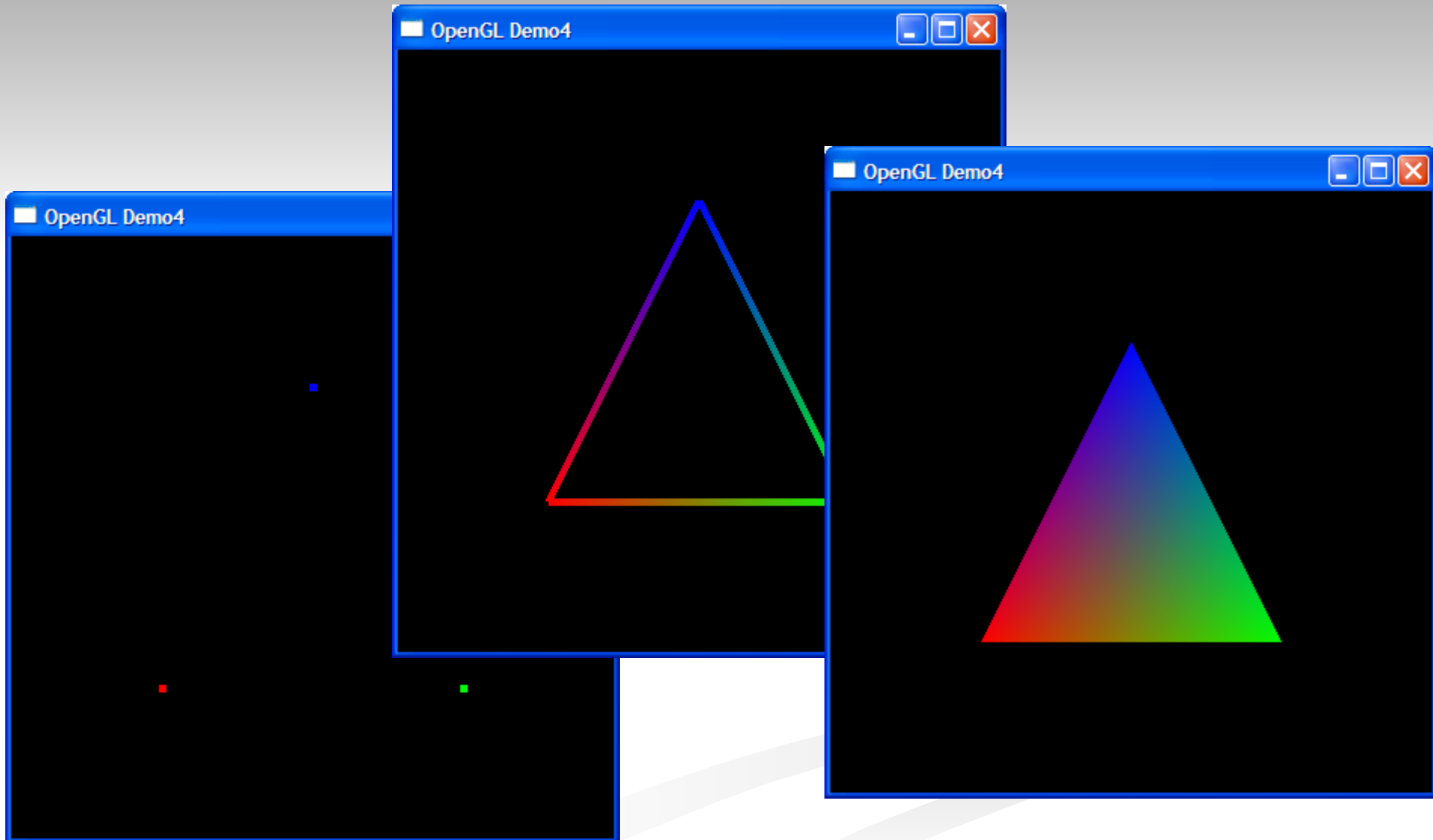
GL_FILL

запълнен

Пример 6 (1/2)

```
glPointSize(5);  
glLineWidth(5);  
glPolygonMode(GL_FRONT_AND_BACK, GL_POINT);  
//glPolygonMode(GL_FRONT_AND_BACK, GL_LINE);  
//glPolygonMode(GL_FRONT_AND_BACK, GL_FILL);  
glBegin(GL_TRIANGLES);  
    glColor3d(1,0,0);  
    glVertex2d(-1.0, -1.0);  
    glColor3d(0,1,0);  
    glVertex2d(1.0, -1.0);  
    glColor3d(0,0,1);  
    glVertex2d(0.0, 1.0);  
glEnd();
```

Пример 6 (2/2)



Щриховка на многоъгълници

```
void glPolygonStipple(const GLubyte *mask)
```

```
void glGetPolygonStipple(GLubyte *mask)
```

```
void glPolygonOffset(GLfloat factor,  
GLfloat units)
```

Предна страна на многоъгълник

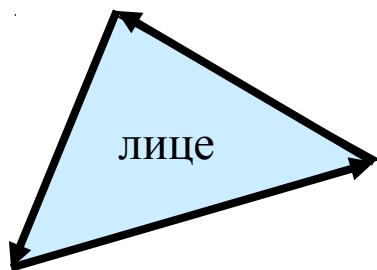
```
void glFrontFace (GLenum mode)
```

mode :

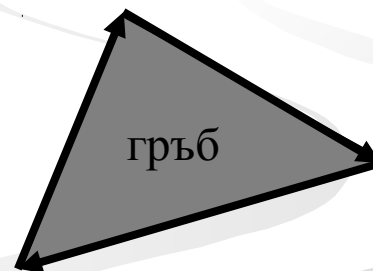
GL_CCW

GL_CW

обратно на часовата
по часовата



при
GL_CCW



Бракуване на многоъгълници

```
glEnable(GL_CULL_FACE);
```

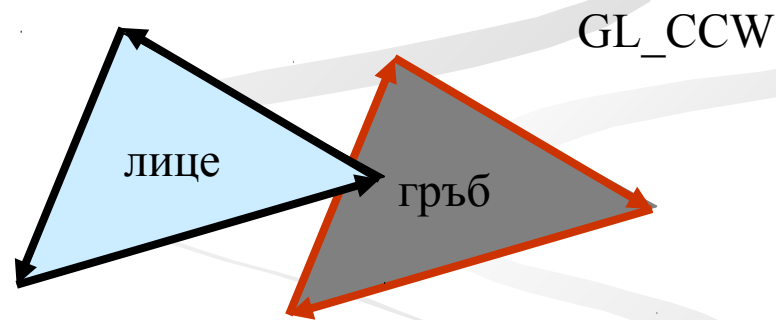
```
void glCullFace(GLenum mode)
```

mode:

```
GL_FRONT
```

```
GL_BACK
```

```
GL_FRONT_AND_BACK
```

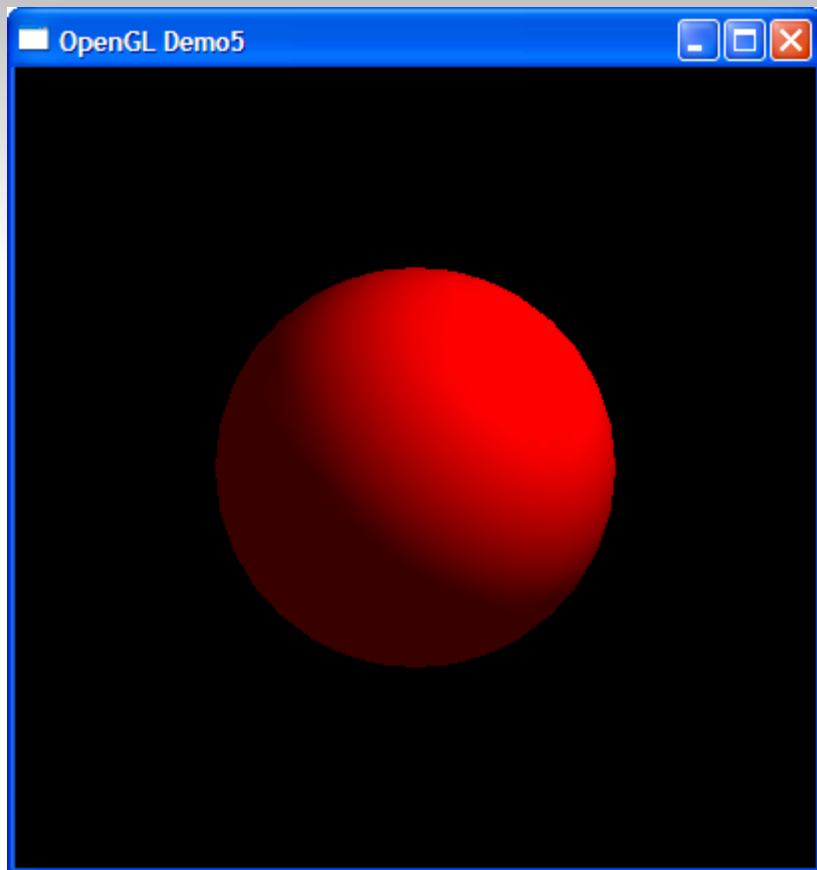


при GL_BACK
задните стени не се растеризират

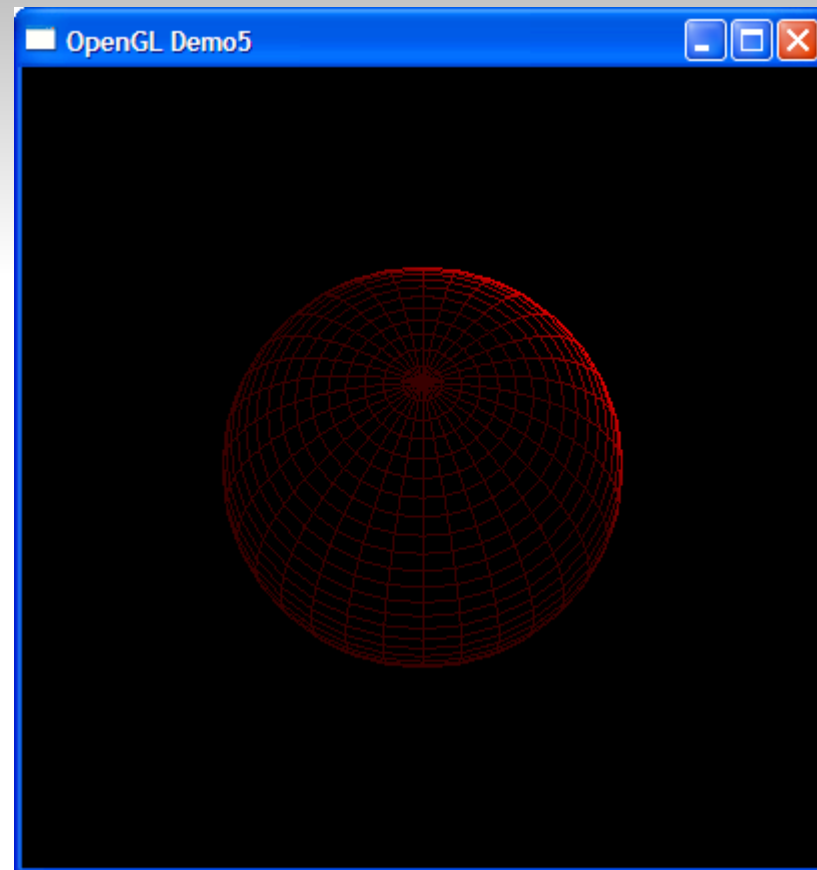
Пример 7 (1/2)

```
glPolygonMode (GL_FRONT, GL_FILL) ;  
glPolygonMode (GL_BACK, GL_LINE) ;  
glEnable (GL_CULL_FACE) ;  
glFrontFace (GL_CCW) ; // GL_CW  
glCullFace (GL_FRONT) ; //GL_BACK  
  
glColor3d (1, 0, 0) ;  
glutSolidSphere (1, 32, 32) ;
```


Пример 7 (2/2)



`glCullFace(GL_BACK)`



`glCullFace(GL_FRONT)`

Скриване на ребра

```
void glEdgeFlag... (GLboolean flag)
```

GL_TRUE

реброто се показва

GL_FALSE

реброто не се показва

OpenGL Изграждане на Геометрични обекти

Въпроси?