Lectures
Animation

By
Tom Duff
Pixar Animation Studios
Emeryville, California
and
George Ledin Jr
Sonoma State University
Rohnert Park, California

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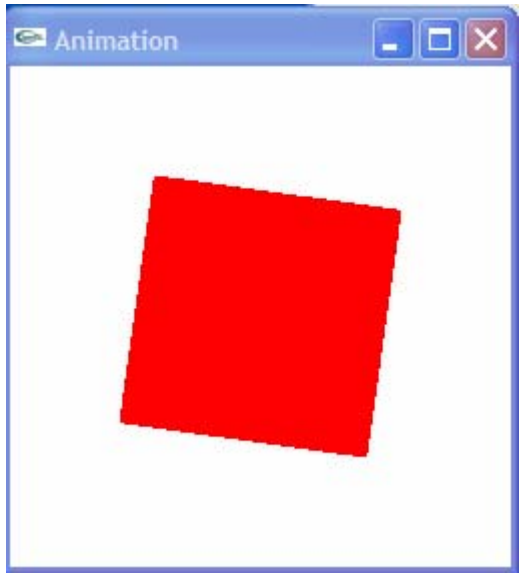
Case 1
A cube centered at (0,0,0) rotating about its center.

- Setup:
  - A cube centered at (0,0,0), the center of the screen.
- Goal:
  - Make the cube rotate by clicking the left button.
  - Make the cube stop rotating by clicking the middle button.



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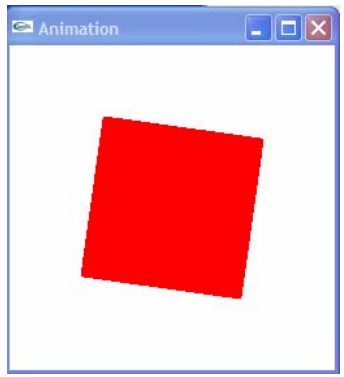
Example of how does OpenGL recognize mouse activity?

```
void mouse(int button,
           int state,
           int x,
           int y)
{
   switch (button) {
      case GLUT_LEFT_BUTTON:
         if (state == GLUT_DOWN)
          glutIdleFunc(spinDisplay);
         break;

      case GLUT_MIDDLE_BUTTON:
         if (state == GLUT_DOWN)
            glutIdleFunc(NULL);
         break;

      default:
         break;
   }
}
// in main
glutMouseFunc(mouse)
```

- Mouse() function is a call back function for glutMouseFunc.
- When user clicks the left button of a PC mouse:
  - button value will be GL_LEFT_BUTTON
  - state value will be GLUT_DOWN.
- When user clicks the middle button of a PC mouse:
  - button value will be GL_MIDDLE_BUTTON
  - state value will be GLUT_DOWN.



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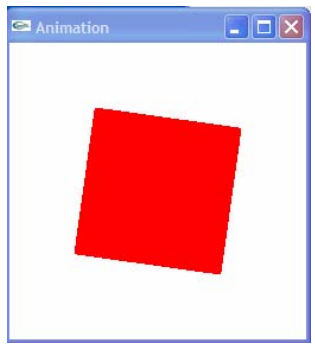
The key animation function to invoke is glutIdleFunc()

```
void mouse(int button,
           int state,
           int x,
           int y)
{
   switch (button) {
      case GLUT_LEFT_BUTTON:
         if (state == GLUT_DOWN)
          glutIdleFunc(spinDisplay);
         break;

      case GLUT_MIDDLE_BUTTON:
         if (state == GLUT_DOWN)
            glutIdleFunc(NULL);
         break;

      default:
         break;
   }
}
// in main
glutMouseFunc(mouse)
```

- glutIdleFunc called the global idle callback function so that a GLUT program can perform background processing tasks or continuous animation when window system events are not being received.

- In our example:
- `glutIdleFunc(spinDisplay);`
  - Call spinDisplay function to do the rotation animation.

- `glutIdleFunc(NULL);`
  - Make glutIdleFunc() do nothing, which means stop the animation.



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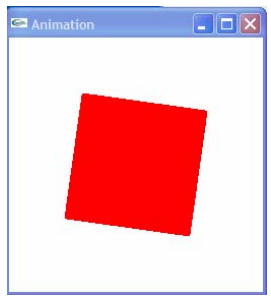
How is the square rotation defined?

```
static GLfloat spin = 0.0;
void spinDisplay(void)
{
   spin = spin + 2.0;
   if (spin > 360.0)
      spin = spin - 360.0;
   glutPostRedisplay();
}

void display(void)
{
   glClear(GL_COLOR_BUFFER_BIT);

   glPushMatrix();
    glRotatef(spin, 0.0, 0.0, 1.0);
    glColor3f(1.0, 0, 0);
    glRectf(-25.0, -25.0, 25.0, 25.0);
    glPopMatrix();
   glutSwapBuffers();
}
```

- Each time spinDisplay function is called, global variable spin, the degree of rotation in display() function is incremented by 2 degrees.
- When spin > 360, subtract 360 spin to avoid passing a spin value that would overflow the glRotatef() parameter's upbound.
- glutPostRedisplay() is called to refresh the display.
  - Whenever glutPostRedisplay is called, the display() function of glutDisplayFunc(display) will be invoked.



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Why use `glutSwapBuffers();` instead of `glFlush()`?

- Most graphics displays are built so that the screen that you see is redrawn or refreshed at a fixed rate.
- This process requires that the display hardware take the contents of the color buffer and use these values to determine the colors in the graphics window on the screen.
- This refresh process is uncoordinated (or asynchronous) with the user program.
- Consequently, the user program is creating new values in the color buffer at the same time that the display process is taking these values out for display.

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