Com S 336
Fall 2022
Homework 5

Please submit an archive on Canvas including the files indicated at the beginning of each problem. The second problem is actually quite short, but will require you to read and modify the shader code for doing lighting and textures.
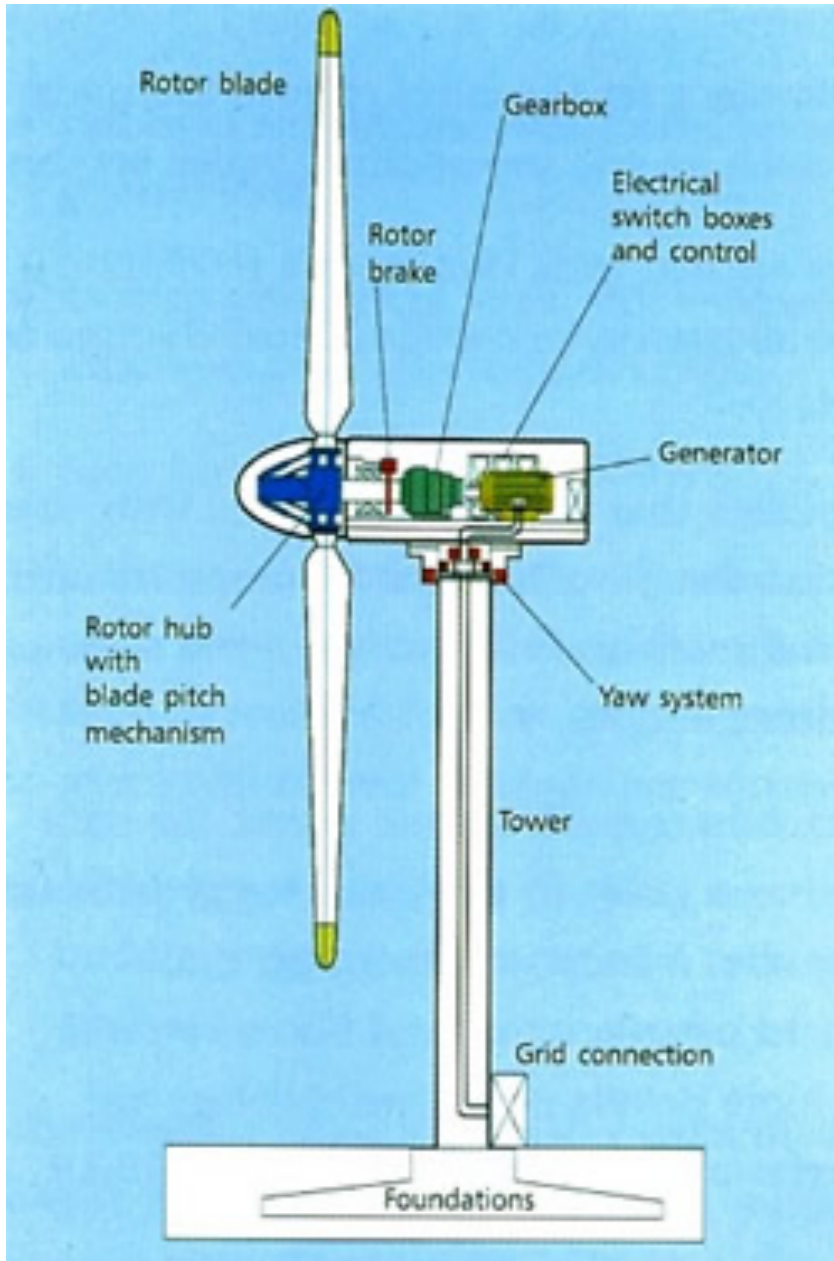
1. (*Please turn in your modified version of HierarchyWithTree3.js.*)

Create a hierarchical scene using the techniques of HierarchyWithTree3.js. Your basic task is to create a clunky model of a wind turbine using five simple objects. Parts should include

- a vertical shaft, or tower,
- a generator housing at the top of the shaft,
- a rotor hub, and
- two rotor blades.

The housing should turn on the vertical shaft (the "yaw" control to make it face the wind), the rotor should rotate, and the blades themselves should rotate relative to the rotor to adjust the "pitch" of the blades (angle relative to the rotor). Animate the rotor to rotate continuously, and add some keyboard controls for yaw and the blade pitch. (If you are feeling ambitious: use scaled spheres for the blades instead of cubes; use a cylinder for the generator housing; make the rotation speed dependent on the blade pitch.)

On the next page is a basic diagram. (Obviously you should ignore internal details such as the "Generator" and "Rotor brake".)
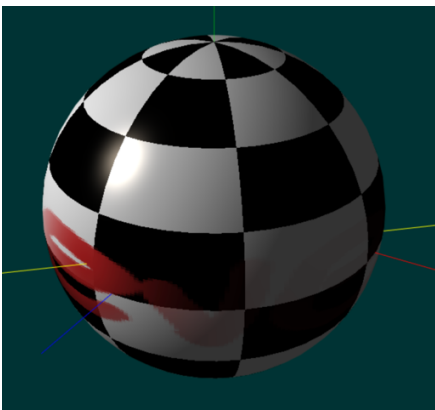
Rotor blade

Gearbox

Electrical
switch boxes
and control

Rotor
brake

Generator

Rotor hub
with
blade pitch
mechanism

Yaw system

Tower

Grid connection

Foundations

2. (*Please turn in your modified version of LightingWithTextureForHW5.js*)

The code **examples/homework5/LightingWithTextureForHW5.js** is similar to the previous example LightingWithTextureAndModel but it has the spot light direction and controls from homework 4 built into it. However, the spot light data is not currently used for anything except to draw the yellow line indicating the spot direction. (The light that is actually used for lighting the scene is in a fixed position.). Out of the box, it is set up to use an image with a transparent background and "decal" it over the existing surface color.

a) Modify the application so that it has two textures. Use one for the surface color, and one for the "decal" effect. Using a checkerboard for the second texture, it would look like this, for example:
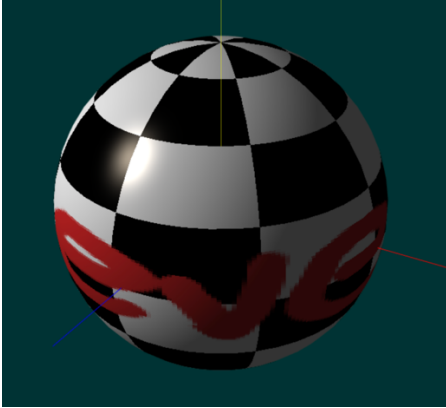
b) This part creates a cool effect. Imagine there is secret writing on the surface of an object that can only be seen by shining an ultraviolet light or some special wavelength on it. You have a special flashlight (the spot light) that shines the required wavelength, so within the beam of this flashlight, the writing becomes visible. Otherwise, the flashlight has no effect on the scene, since the "light" it emits is not visible light. It might look like this (note the direction of the yellow line, indicating what would be the spot direction).

For a better illustration, see
https://stevekautz.com/cs336f22/examples/homework5/animation2.mp4