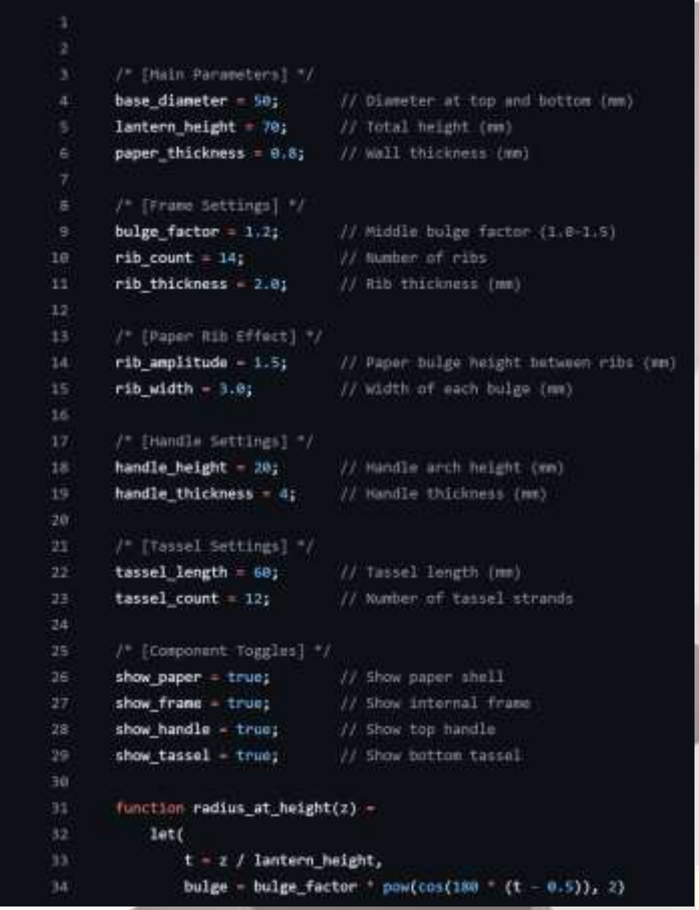
Procedural Chinese Lantern Using OpenSCAD

Group One

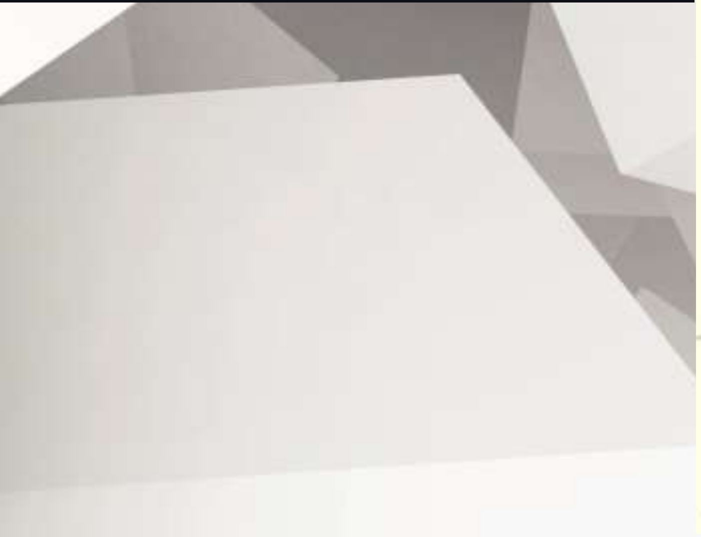
Hongcheng Pan

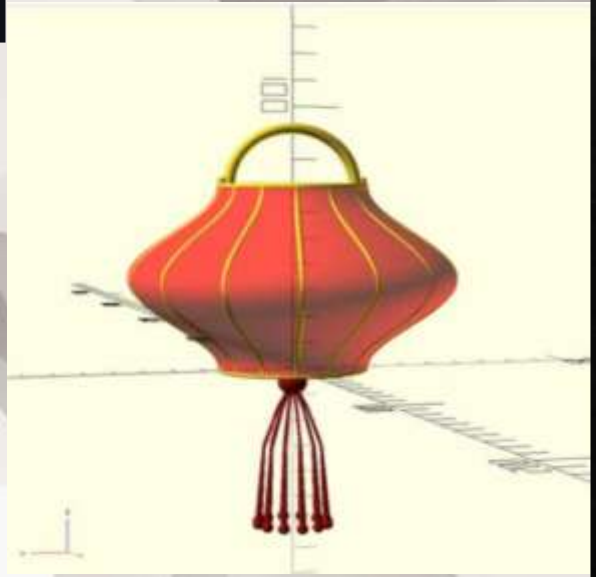
Sicheng xi

Yubo Wang



```
/* [Main Parameters] */
base_diameter = 50;       // Diameter at top and bottom (mm)
lantern_height = 70;      // Total height (mm)
paper_thickness = 0.8;    // Wall thickness (mm)

/* [Frame Settings] */
bulge_factor = 1.2;       // Middle bulge factor (1.0-1.5)
rib_count = 14;           // Number of ribs
rib_thickness = 2.0;      // Rib thickness (mm)

/* [Paper Rib Effect] */
rib_amplitude = 1.5;      // Paper bulge height between ribs (mm)
rib_width = 3.0;          // Width of each bulge (mm)

/* [Handle Settings] */
handle_height = 20;       // Handle arch height (mm)
handle_thickness = 4;     // Handle thickness (mm)

/* [Tassel Settings] */
tassel_length = 60;       // Tassel length (mm)
tassel_count = 12;        // Number of tassel strands

/* [Component Toggles] */
show_paper = true;        // Show paper shell
show_frame = true;        // Show internal frame
show_handle = true;       // Show top handle
show_tassel = true;       // Show bottom tassel

function radius_at_height(z) =
    let(
        t = z / lantern_height,
        bulge = bulge_factor * pow(cos(180 * (t - 0.5)), 2)
```



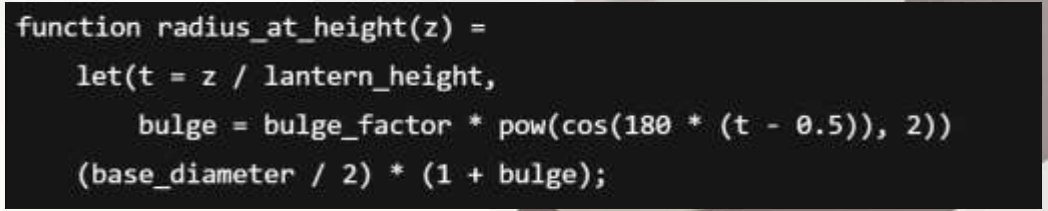


Project Overview Goals

- This project demonstrates a fully procedural Chinese lantern model created using OpenSCAD.
  All geometry is generated through code, avoiding traditional 3D modeling software.
  The focus is on parametric control, modular structure, and script-driven rendering logic.
- **Key Objectives:**
- Translate mathematical logic into customizable geometry
- Achieve clean component separation (shell, frame, handle, tassel)
- Enable interactive parameter tuning (height, diameter, rib count, etc.)
- Provide a realistic visual with clear internal structure

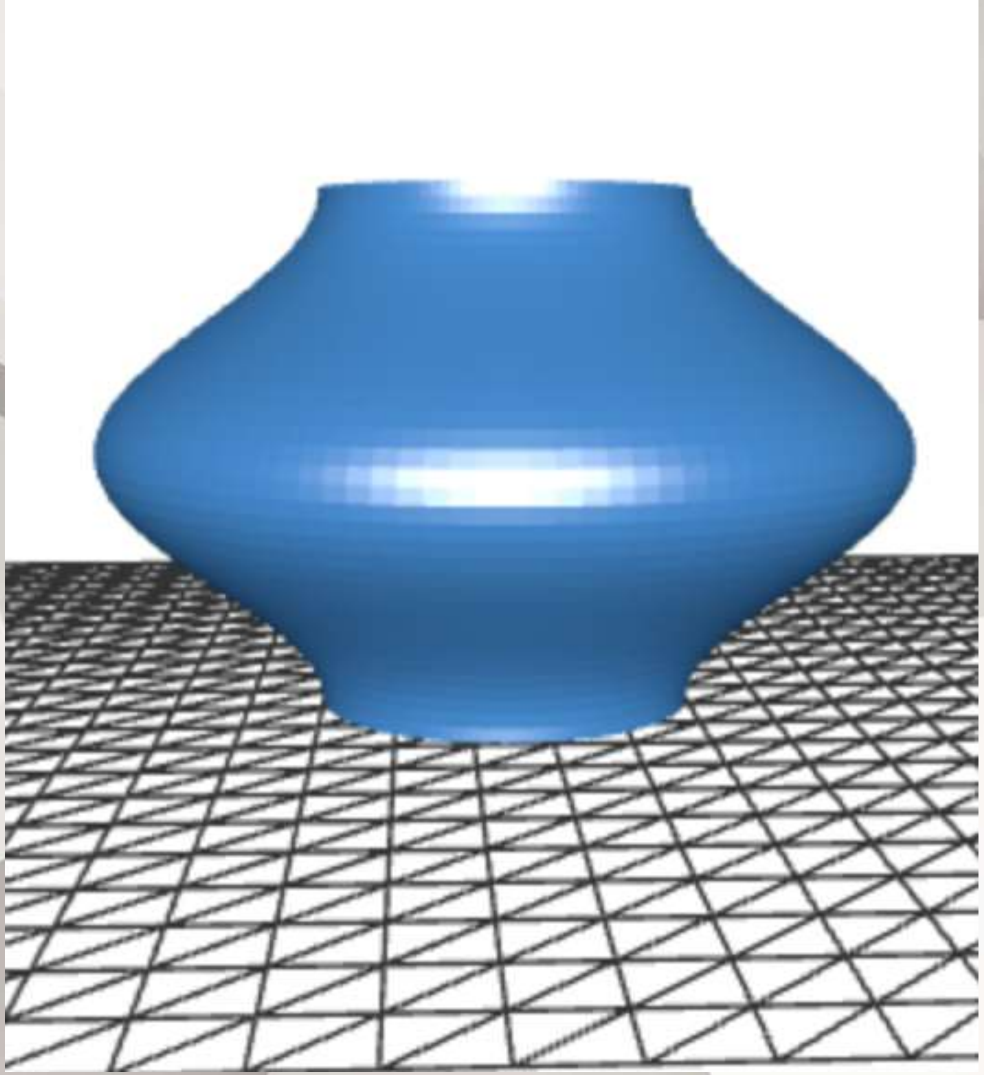
Parametric Design & Radius Function

The lantern profile is defined using a custom function radius_at_height(z)
which controls curvature based on height and a configurable bulge factor. 👇



```
function radius_at_height(z) =
    let(t = z / lantern_height,
        bulge = bulge_factor * pow(cos(180 * (t - 0.5)), 2))
    (base_diameter / 2) * (1 + bulge);
```

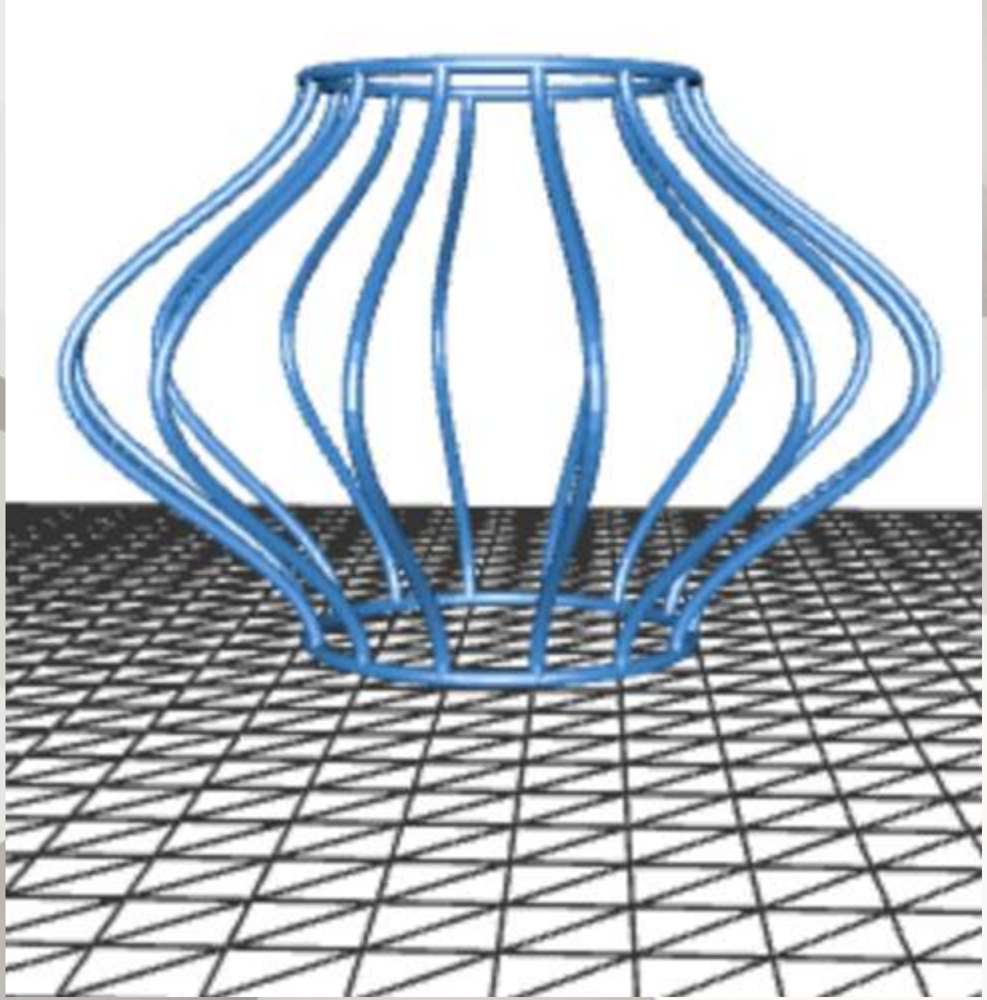
Key Parameters:
lantern_height
base_diameter
bulge_factorrib_count
rib_thickness
rib_amplitudepaper_thickness,
tassel_count
handle_height



Shell & Frame Construction

The outer paper shell and internal frame are generated separately using rotate_extrude() and hull() operations. Shell thickness is controlled via nested difference() of outer and inner profiles.
Ribs are constructed with connected spheres to maintain smooth curvature.

Techniques Used:
•2D profile revolution (rotate_extrude)
•Boolean difference modeling (difference)
•Discrete rib lattice (hull + spheres)
•Paper rib texture simulated by extruded bulge shapes
•Circular decorations arranged via rotation loop



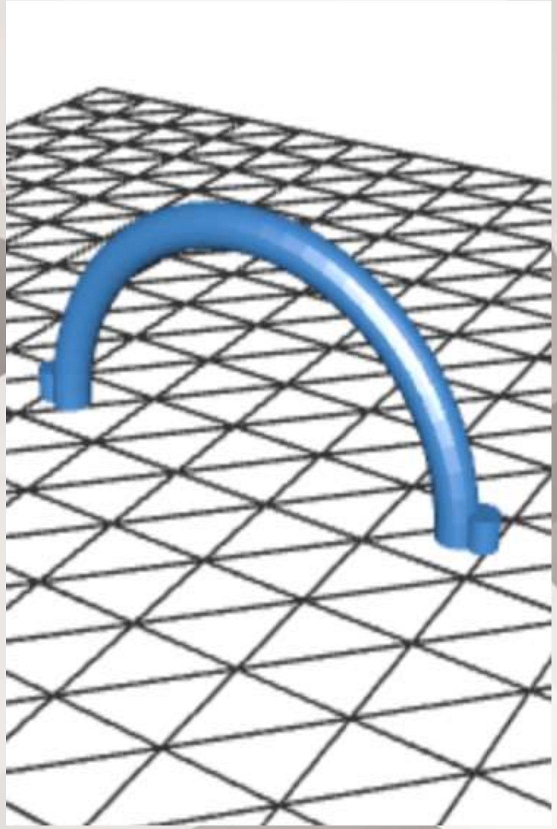
Handle & Tassel Modules

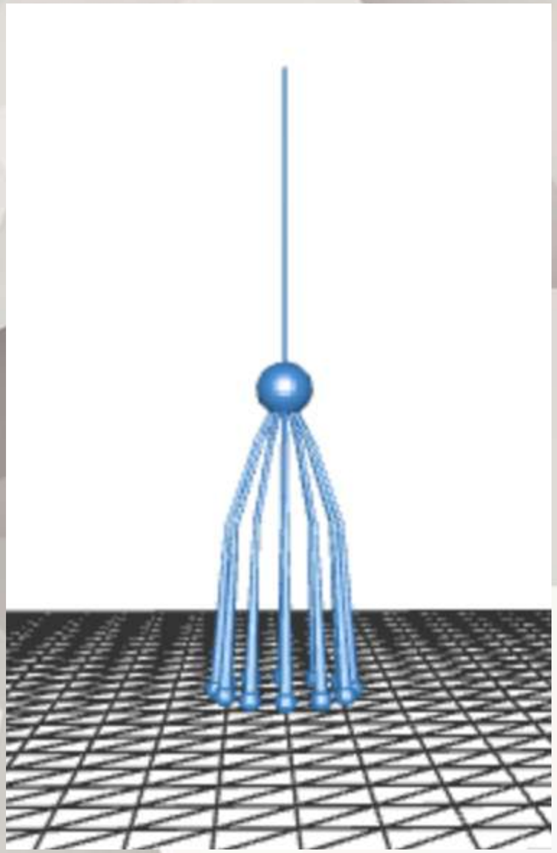
The top handle is modeled as a half torus using rotate_extrude(angle=180) with adjustable width and thickness.

The bottom tassel is constructed via a central sphere and multiple curved strands using chained spheres and hull().

Highlights:

- Parametric handle width from top radius
- Symmetrical tassel strands following Bezier-style paths
- Central gold thread using cylinder
- Individual strand ends are capped with decorative spheres





Conclusion & Reflection

This project successfully demonstrates a complete procedural modeling pipeline in OpenSCAD.
By translating mathematical functions into modular geometry, we explored the power of script-driven CAD thinking.

The following are the gains of each of us.

I think I learned the basic knowledge of computer graphics and the principle of generating images in the project. And some insights into game design and art. From the project, I have clarified my future bias direction and learned the basic application of openscad.

Through this project, I gained hands-on experience in procedural modeling using OpenSCAD.I learned how to translate mathematical logic into 3D geometry and how to construct modular structures using parameterized code.This process enhanced my understanding of CAD thinking and the power of script-based modeling.

还有一人未写，写完粘贴格式刷前两个即可

Thanks For Your Listening!