

Zep-CAD

Mini-CAD Software for Zeppelin Modeling

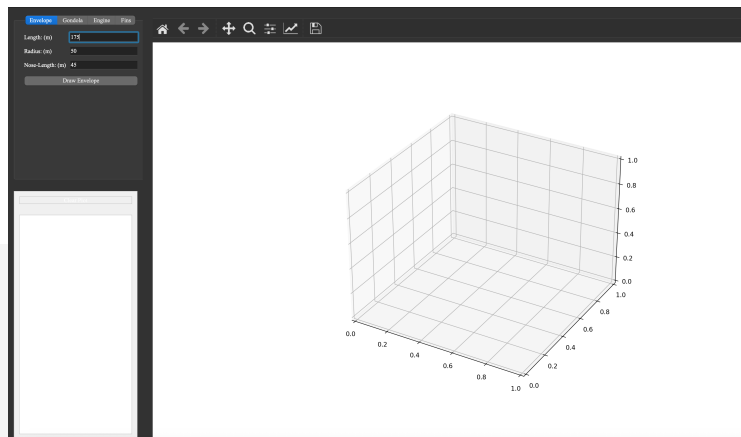
Evan Blosser, Matthew Dobbs, Blake Johnson
University of Oklahoma
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Project Objective

- ▶ Develop lightweight Python-based CAD tool to support conceptual Zeppelin design.
- ▶ Enable parametric modeling and real-time surface regeneration.
- ▶ Provide user-friendly GUI interface using PySide6 and Matplotlib.

GUI Layout



Tabbed interface with Envelope, Gondola, Engine, and Fins control panels.

Code Structure

```
Zeppelin_CAD > main.py > ...
1 import sys
2 import numpy as np
3 import matplotlib.pyplot as plt
4 from scipy.interpolate import CubicSpline
5
6 from PySide6 import QtCore, QtWidgets, QtGui
7 from PySide6.QtWidgets import (QApplication, QMainWindow, QVBoxLayout, QHBoxLayout,
8                                QWidget, QLabel, QLineEdit, QPushButton, QTextEdit, QTabWidget,
9                                QMenuBar, QComboBox, QScrollArea, QListView, QFileDialog,
10                               QFileSystemModel, QGridLayout, QSlider, QMessageBox)
11 from PySide6.QtGui import QPainter, QPen, QColor, QBrush
12 from PySide6.QtCore import Qt, QRectF
13 from matplotlib.backends.backend_qtagg import FigureCanvasQTAgg as FigureCanvas
14 from matplotlib.backends.backend_qtagg import NavigationToolbar2QT as NavigationToolbar
15 from mpl_toolkits.mplot3d.art3d import Poly3DCollection
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17 sys.dont_write_bytecode = True
18 from config import clear_plot, save_as_stl, merge_wireframes
19 from Envelope import draw_envelope
20 from Engine import draw_engine
21 from Gondola import draw_canoe_gondola
22 from Fins import build_fin, Ro_x
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25 class PlotCanvas(FigureCanvas):
26     def __init__(self, parent=None):
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```

OUTPUT DEBUG CONSOLE TERMINAL 41 PORTS

PROBLEMS

Filter (e.g. text, **/*.ts, !**/node_...)

main.py Zeppelin_CAD 6

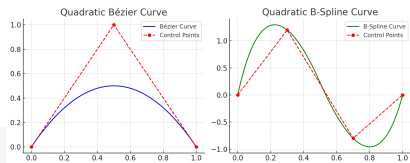
- PyLance(reportMissingImports)
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1 or ... or 9 to ignore the next 1 to 9 tokens of input,
H for help, X to quit.
? x
</usr/local/texlive/2024/texmf-dist/fonts/type1/urw/palatino/uplrb8a.pfb></usr/local/texlive/2024/texmf-dist/fonts/type1/urw/palatino/uplrb8a.pfb>
Output written on project 2.pdf (1 page, 43029 bytes).
Transcript written on project 2.log.
❖ (base) blakejohnson@MacBookPro Zeppelin_CAD % /usr/local/bin/python3 /Users/blakejohnson/Documents/spring_2025/ame_5193_cad/Zeppelin_CAD/Zep_CAD_project_2/code/main.py
qt.qpa.fonts: Populating font family aliases took 118 ms. Replace uses of missing font family "Consolas" with one that exists to avoid this cost.

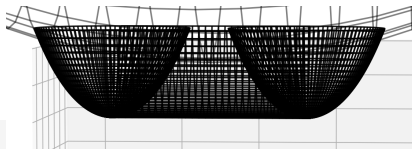
Modular design using main.py and independent geometry modules



Curve and Surface Types

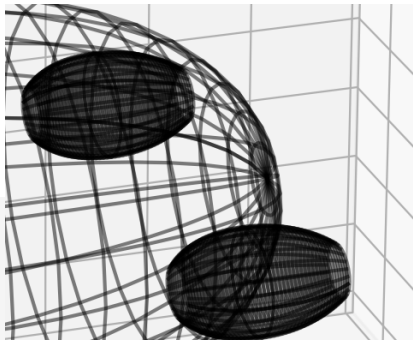


Bézier, B-spline, cubic, and quadratic spline curves.

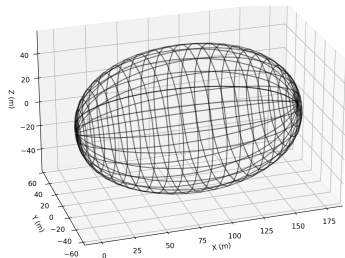


Revolved, ruled, and lofted surface examples.

Transformations

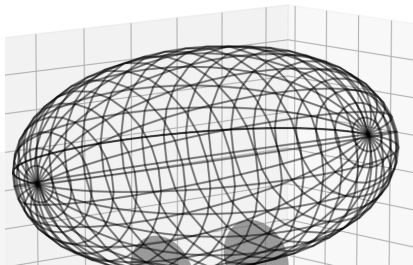


Engine translated laterally for spacing.

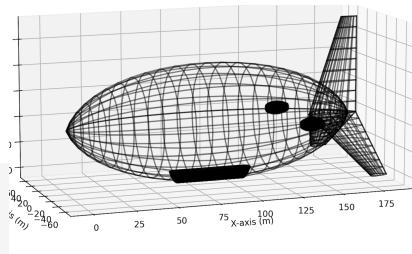


Fins rotated around envelope axis.

Model Variations: Nose Profiles



Standard nose geometry.



Sharpened nose via control point adjustment.

Planned Enhancements

- ▶ Implement gondola-envelope intersection trimming.
- ▶ Add STL export capabilities for 3D printing.
- ▶ Introduce shaded rendering and interactive rotation.

Demonstration Video

(Time for a Demonstration Video)

Lessons Learned

- ▶ Integration of symbolic and numerical math for CAD.
- ▶ Importance of modular GUI architecture in engineering tools.
- ▶ Applying CAD concepts like lofting and revolving programmatically.

Self-Assessment

- ▶ Delivered a complete modular CAD prototype.
- ▶ Achieved real-time visual updates and user interactivity.
- ▶ Set groundwork for advanced features like trimming and export.

Thank You!

Questions?