1. detail info about the model

The model is dolphin, from Microsoft Pain3d free library.

The file name is `dolphin.stl` .

The file size is `776,584` bytes
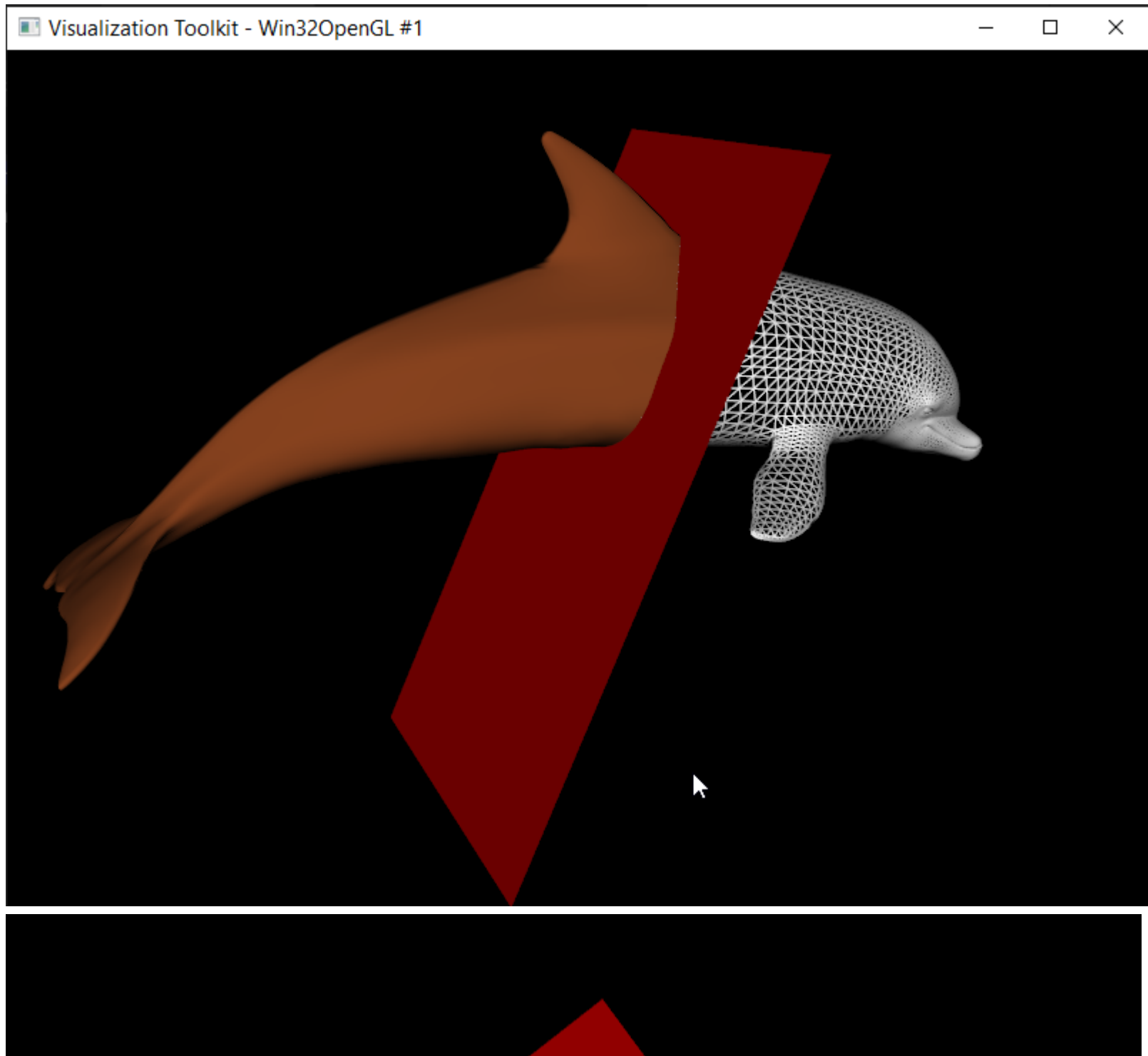
Number Of Points: 7767

Number Of Cells: 15530

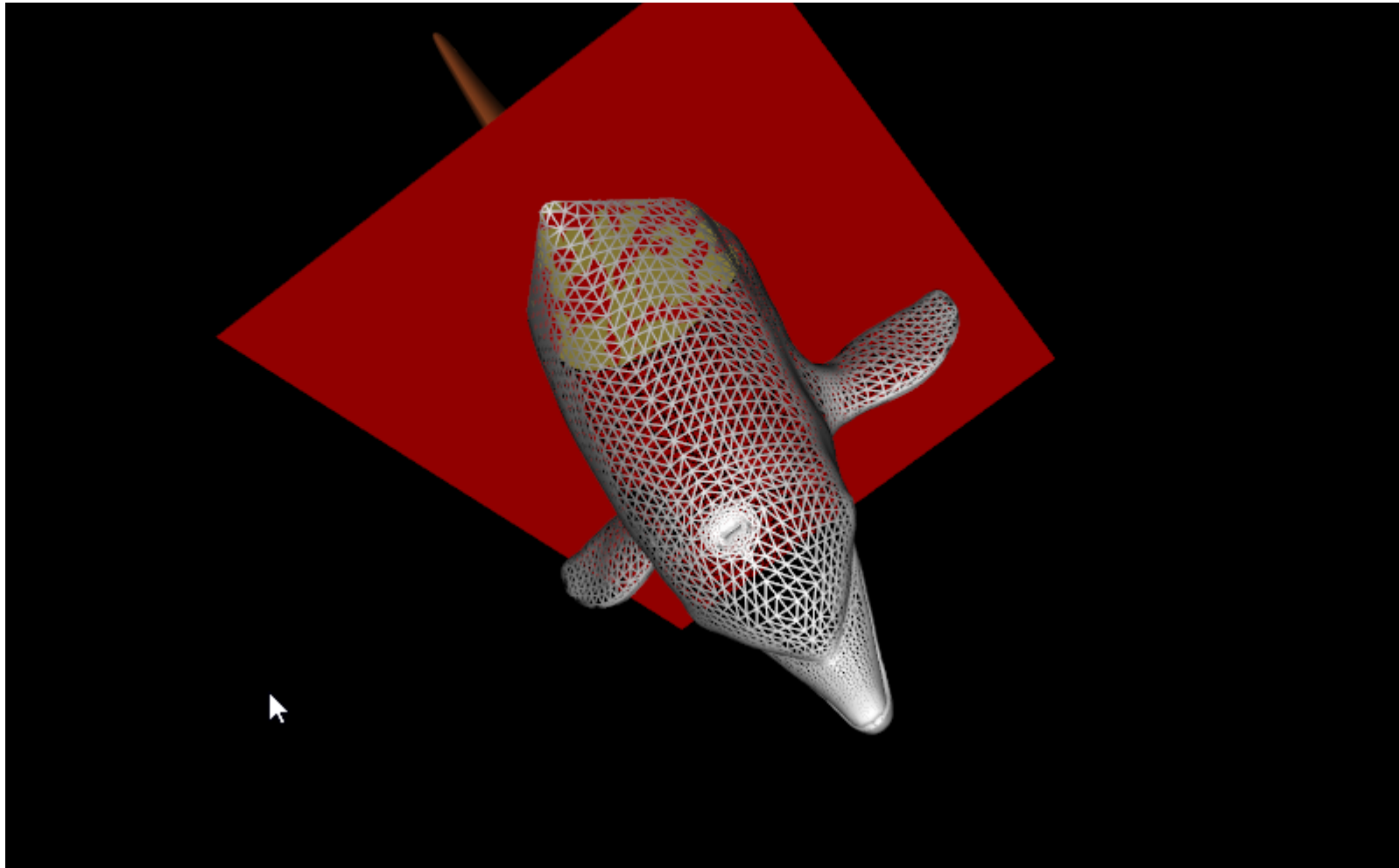# 2. Information of each part

```
Original Data: Nubmer of Cells:15530 Number of Points 7767
clipped data: Nubmer of Cells:6658 Number of Points 7889
Rest Data: Nubmer of Cells:9116 Number of Points 7889
```
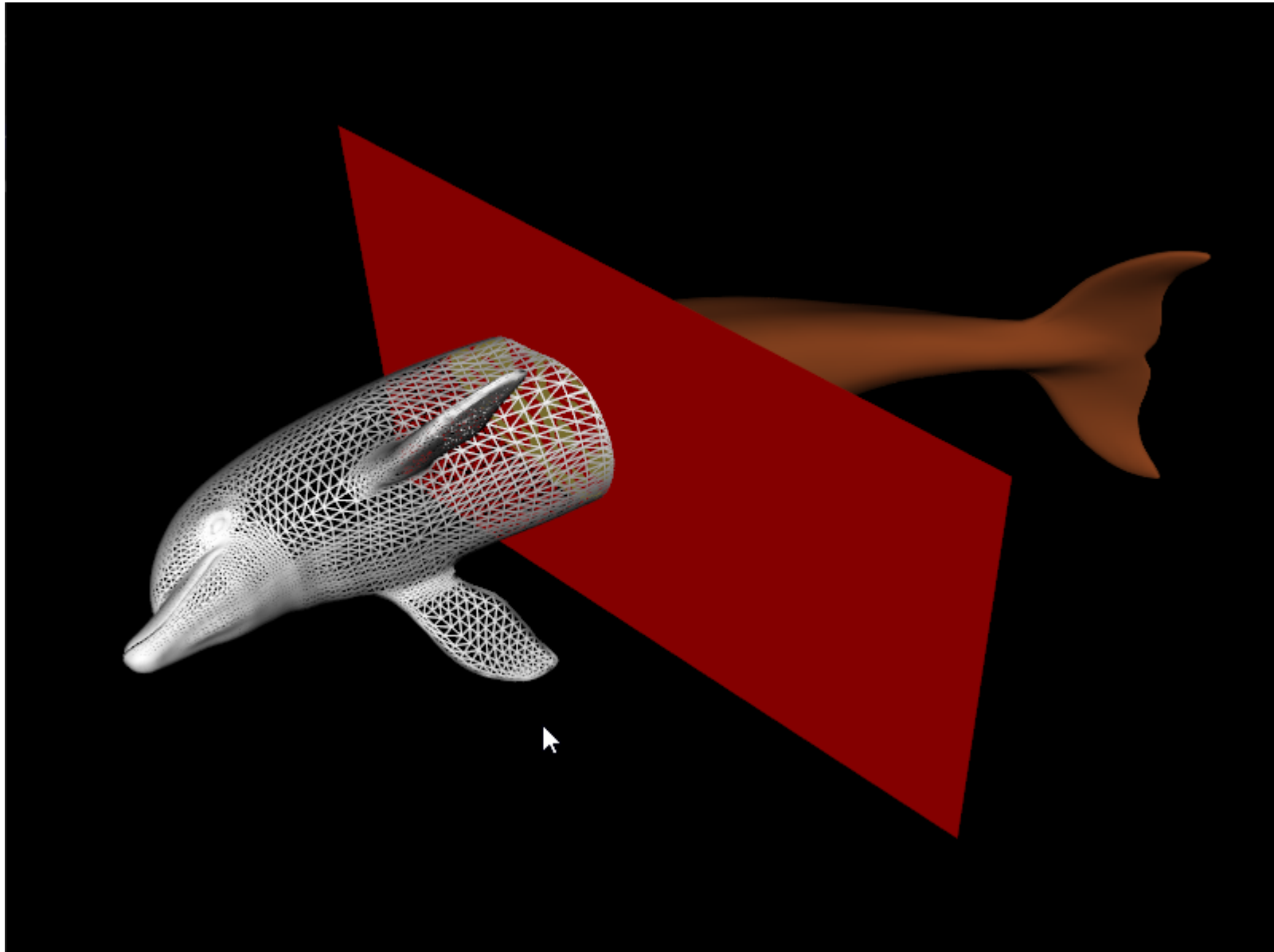
3. Screenshots

4. Source code

The source is under this section.

In [ ]:

```
## Install vtk

# Install VTK to virtual environment as needed

# windows
! pip install https://www.vtk.org/files/release/9.1/vtk-9.1.0-cp39-cp39-win_amd64.whl

# Linux
# ! pip install https://www.vtk.org/files/release/9.1/vtk-9.1.0-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86_64.wh
```

```
Collecting vtk==9.1.0
  Using cached https://www.vtk.org/files/release/9.1/vtk-9.1.0-cp39-cp39-win_amd64.whl (44.7 MB)
Requirement already satisfied: wslink>=1.0.4 in c:\java\python39\lib\site-packages (from vtk==9.1.0) (1.3.1)
Requirement already satisfied: matplotlib>=2.0.0 in c:\java\python39\lib\site-packages (from vtk==9.1.0) (3.5.1)
Requirement already satisfied: numpy>=1.17 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.1.0)
(1.22.0)
Requirement already satisfied: python-dateutil>=2.7 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk=
=9.1.0) (2.8.2)
Requirement already satisfied: cycler>=0.10 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.1.0)
(0.11.0)
Requirement already satisfied: packaging>=20.0 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.1.
0) (21.3)
Requirement already satisfied: pyparsing>=2.2.1 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.
1.0) (3.0.6)
Requirement already satisfied: fonttools>=4.22.0 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.
1.0) (4.28.5)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.
1.0) (1.3.2)
Requirement already satisfied: pillow>=6.2.0 in c:\java\python39\lib\site-packages (from matplotlib>=2.0.0->vtk==9.1.0)
(9.0.0)
Requirement already satisfied: aiohttp in c:\java\python39\lib\site-packages (from wslink>=1.0.4->vtk==9.1.0) (3.8.1)
Requirement already satisfied: six>=1.5 in c:\java\python39\lib\site-packages (from python-dateutil>=2.7->matplotlib>=
2.0.0->vtk==9.1.0) (1.16.0)
Requirement already satisfied: yarl<2.0,>=1.0 in c:\java\python39\lib\site-packages (from aiohttp->wslink>=1.0.4->vtk==
9.1.0) (1.7.2)
Requirement already satisfied: attrs>=17.3.0 in c:\java\python39\lib\site-packages (from aiohttp->wslink>=1.0.4->vtk==
9.1.0) (21.4.0)
Requirement already satisfied: multidict<7.0,>=4.5 in c:\java\python39\lib\site-packages (from aiohttp->wslink>=1.0.4->
vtk==9.1.0) (5.2.0)
Requirement already satisfied: aiosignal>=1.1.2 in c:\java\python39\lib\site-packages (from aiohttp->wslink>=1.0.4->vtk
==9.1.0) (1.2.0)
Requirement already satisfied: frozenlist>=1.1.1 in c:\java\python39\lib\site-packages (from aiohttp->wslink>=1.0.4->vt
k==9.1.0) (1.2.0)
Requirement already satisfied: charset-normalizer<3.0,>=2.0 in c:\java\python39\lib\site-packages (from aiohttp->wslink
>=1.0.4->vtk==9.1.0) (2.0.10)
Requirement already satisfied: async-timeout<5.0,>=4.0.0a3 in c:\java\python39\lib\site-packages (from aiohttp->wslink>
=1.0.4->vtk==9.1.0) (4.0.2)
Requirement already satisfied: idna>=2.0 in c:\java\python39\lib\site-packages (from yarl<2.0,>=1.0->aiohttp->wslink>=
1.0.4->vtk==9.1.0) (3.3)
WARNING: You are using pip version 21.3.1; however, version 22.0.3 is available.
You should consider upgrading via the 'C:\Java\Python39\python.exe -m pip install --upgrade pip' command.
```

In [ ]:
```python
import vtk
```

```
print(vtk.vtkVersion().GetVTKSourceVersion())
```

vtk version 9.1.0

In [ ]:

```python
## Code for assginment2

from matplotlib.pyplot import plot_date
import numpy as np
import vtk
from vtk.util.colors import brown_ochre, tomato, banana
from vtkmodules.vtkInteractionStyle import vtkInteractorStyleTrackballCamera

# 1. Read model
reader = vtk.vtkSTLReader()
reader.SetFileName("dolphin.stl")
reader.Update()
poly_data = reader.GetOutput()


normals = vtk.vtkPolyDataNormals()
# normals.SetInputConnection(reader.GetOutputPort())
normals.AddInputData(poly_data)

# 2. set Plane center to model center
center = poly_data.GetCenter()

plane = vtk.vtkPlane()
# plane.SetOrigin(0, 0, 0)
plane.SetOrigin(center)
plane.SetNormal(-1, 0, 0)


clipper = vtk.vtkClipPolyData()
clipper.SetInputConnection(normals.GetOutputPort())
clipper.SetClipFunction(plane)
clipper.GenerateClipScalarsOn()
clipper.GenerateClippedOutputOn()

# 3. set clipper value
clipper.SetValue(0)
clipMapper = vtk.vtkPolyDataMapper()
clip_data = clipper.GetOutput()
clipMapper.SetInputData(clip_data)
clipMapper.SetInputConnection(clipper.GetOutputPort())
```

```python
clipMapper.ScalarVisibilityOff()
backProp = vtk.vtkProperty()
backProp.SetDiffuseColor(tomato)
clipActor = vtk.vtkActor()
clipActor.SetMapper(clipMapper)
clipActor.GetProperty().SetColor(brown_ochre)
clipActor.SetBackfaceProperty(backProp)

# 4 cutter
cutEdges = vtk.vtkCutter()
cutEdges.SetInputConnection(normals.GetOutputPort())
cutEdges.SetCutFunction(plane)
cutEdges.GenerateCutScalarsOn()
cutEdges.SetValue(0, 0)
cutStrips = vtk.vtkStripper()
cutStrips.SetInputConnection(cutEdges.GetOutputPort())
cutStrips.Update()
cutPoly = vtk.vtkPolyData()
cutPoly.SetPoints(cutStrips.GetOutput().GetPoints())
cutPoly.SetPolys(cutStrips.GetOutput().GetLines())

cutTriangles = vtk.vtkTriangleFilter()
cutTriangles.SetInputData(cutPoly)
cutMapper = vtk.vtkPolyDataMapper()
cutMapper.SetInputData(cutPoly)
cutMapper.SetInputConnection(cutTriangles.GetOutputPort())
cutActor = vtk.vtkActor()
cutActor.SetMapper(cutMapper)
cutActor.GetProperty().SetColor(banana)
cutActor.VisibilityOn()

#
restMapper = vtk.vtkPolyDataMapper()
rest_data = clipper.GetClippedOutput()
# restMapper.SetInputData(rest_data)
restMapper.SetInputData(clipper.GetClippedOutput())
restMapper.ScalarVisibilityOff()
restActor = vtk.vtkActor()
restActor.SetMapper(restMapper)
restActor.GetProperty().SetRepresentationToWireframe()


#create renderers and add actors of plane and cube
```

```python
ren = vtk.vtkRenderer()
renWin = vtk.vtkRenderWindow()
renWin.AddRenderer(ren)
renWin.SetSize(800, 600)
iren = vtk.vtkRenderWindowInteractor()
iren.SetRenderWindow(renWin)

style = vtkInteractorStyleTrackballCamera()
iren.SetInteractorStyle(style)

# 5. display plane
#Sample the plane
sampler = vtk.vtkSampleFunction()
sampler.SetImplicitFunction(plane)

#Set the bounds to be slightly larger
meshBounds = poly_data.GetBounds()
planeBounds = [0, 0, 0, 0, 0, 0]
for i in range(0,3):
    length = 1.2*(meshBounds[2*i+1] - center[i])
    planeBounds[2*i] = center[i] - length
    planeBounds[2*i+1] = center[i] + length

sampler.SetModelBounds(planeBounds)
sampler.ComputeNormalsOff()
sampler.Update()

#Extract the isosurface at 0
contour = vtk.vtkContourFilter()
contour.SetInputData(sampler.GetOutput())
contour.SetValue(0,0.)
contour.Update()

planeMapper = vtk.vtkPolyDataMapper()
planeMapper.SetInputConnection(contour.GetOutputPort())
planeActor = vtk.vtkActor()
planeActor.SetMapper(planeMapper)
planeActor.GetProperty().SetColor(banana)
planeActor.VisibilityOn()


# display data
ren.AddActor(clipActor)
ren.AddActor(cutActor)
```

```python
ren.AddActor(restActor)
ren.AddActor(planeActor)

iren.Initialize()
renWin.Render()

# output data
n1 = poly_data.GetNumberOfCells()
n2 = poly_data.GetNumberOfPoints()
print(f"Original Data: Nubmer of Cells:{n1} Number of Points {n2}")

n3 = clip_data.GetNumberOfCells()
n4 = clip_data.GetNumberOfPoints()
print(f"clipped data: Nubmer of Cells:{n3} Number of Points {n4}")

n5 = rest_data.GetNumberOfCells()
n6 = rest_data.GetNumberOfPoints()
print(f"Rest Data: Nubmer of Cells:{n5} Number of Points {n6}")

iren.Start()
```

```
Original Data: Nubmer of Cells:15530 Number of Points 7767
clipped data: Nubmer of Cells:6658 Number of Points 7889
Rest Data: Nubmer of Cells:9116 Number of Points 7889
```

5. Readme

The VTK version installed is `9.1.0`

Prequirements

1. Python3.8 (The following command is based on Windows)
2. Create virtual environment `Python3.8 -m venv .venv`
3. Upgrade pip `python -m pip install --upgrade pip`
4. The VKT version is 9.1.0

View the report

please read `mm804_assignmet2.pdf`

Run the code

The Report is using this Jupter report, so please run the `mm804_assignmet2.ipynb` One of the cell has VTK install command.