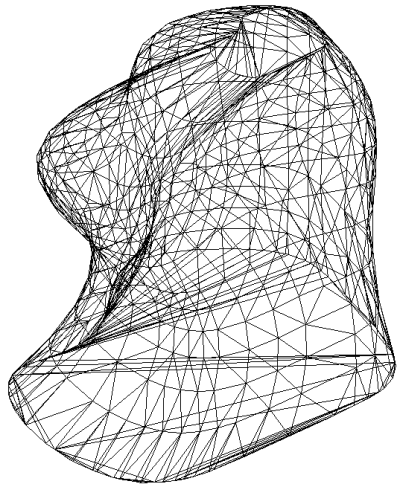
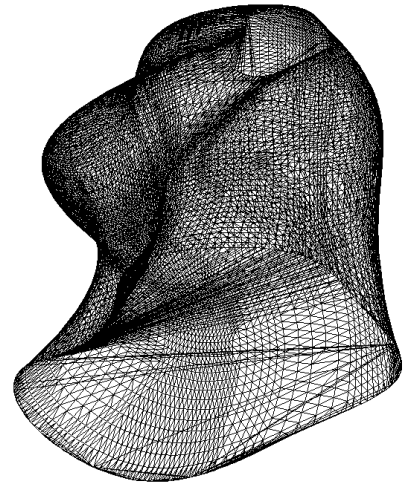
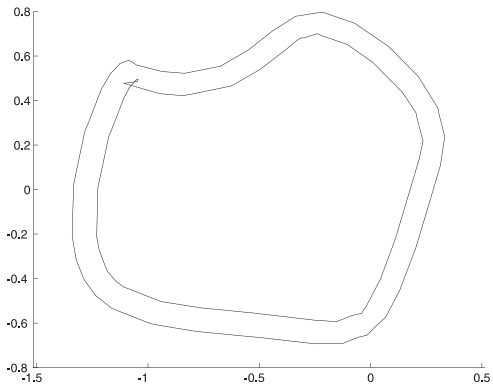


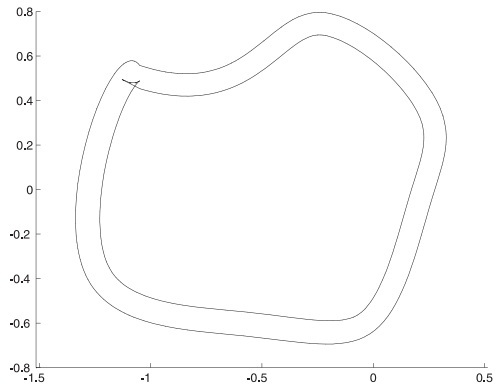
(a) STL model of the example part I
with the adjacency toleance =0.02”
(1,226 triangles)



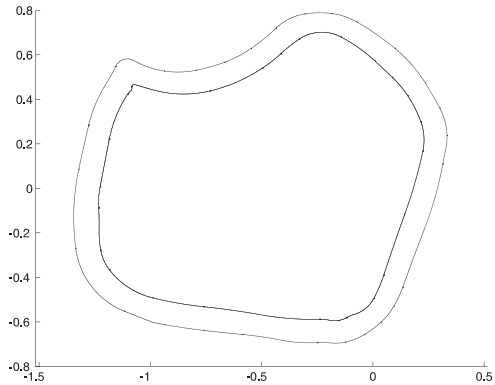
(b) STL model of the example part I
with the adjacency toleance =0.001”
(21,248 triangles)



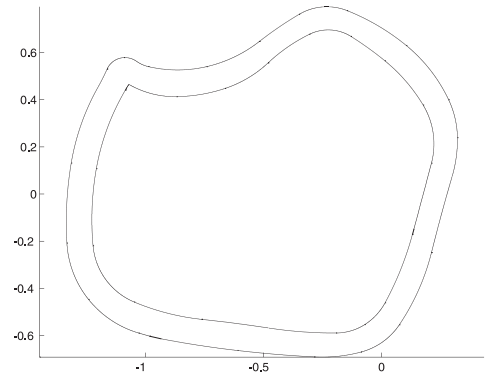
(c) Cross sectional contours of the hollowed
part before biarc fitting (144 line segments)
(adjacency tolerance = 0.02”)



(d) Cross-sectional contours of the hollowed
part before biarc fitting (580 line segments)
(adjacency tolerance = 0.001”)



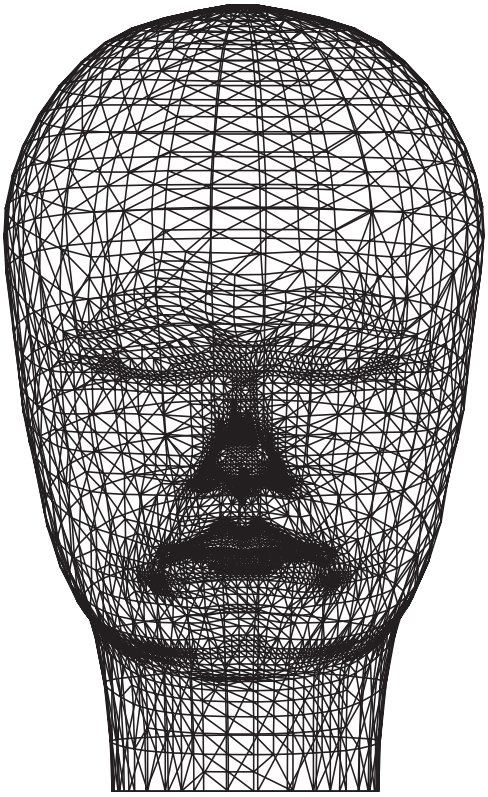
(e) Same cross-sections after
biarc fitting (31 biarc segments)



(f) Same cross-sections after
biarc fitting (21 biarc segments)

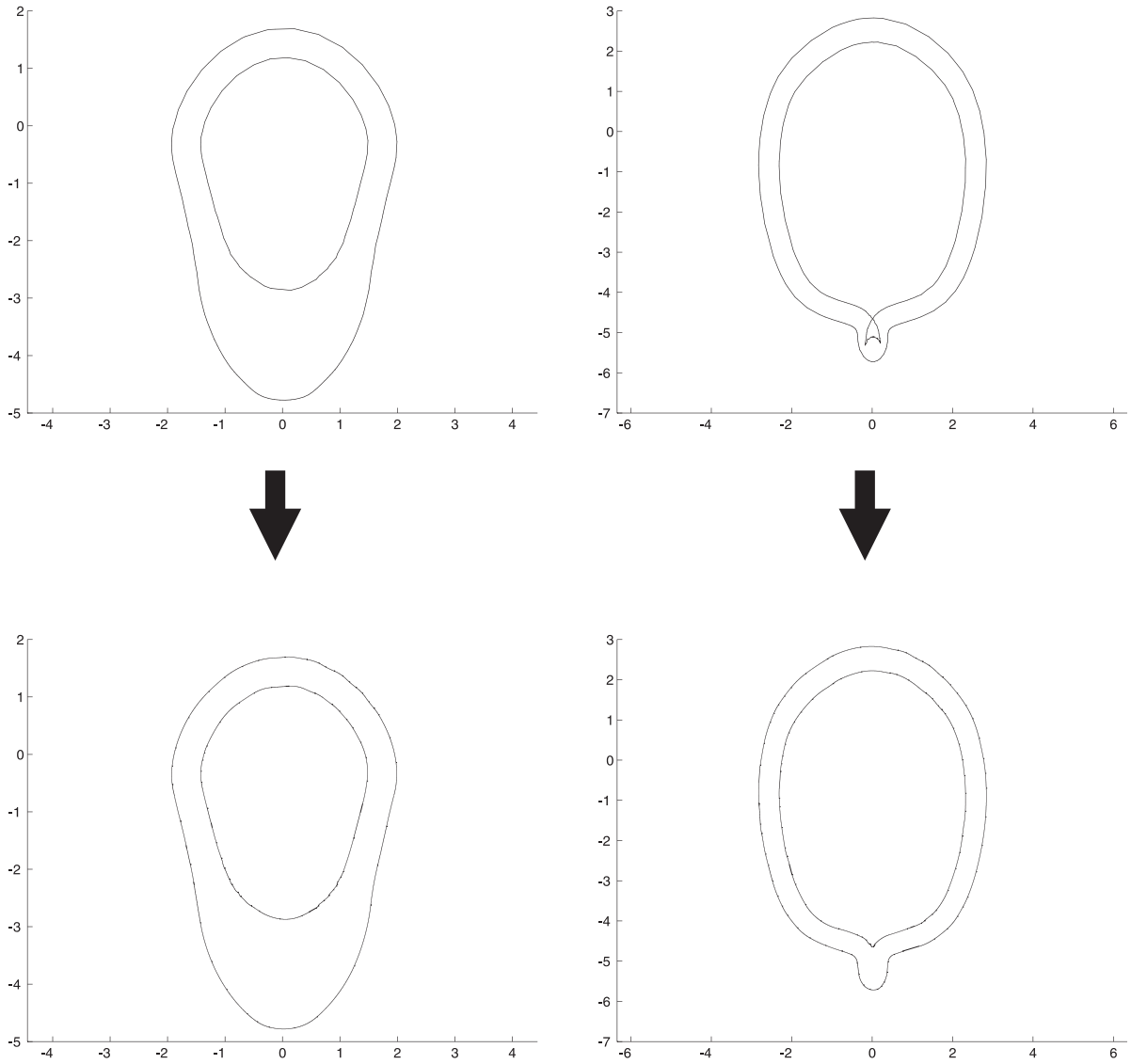
Figure 6.14 Cross-sectional contour of the hollowed parts created from STL models of the example part I with different adjacency accuracy and their biarc curves

(a) Solid model of the example par t V



(b) 3D view of STL model of the example part V

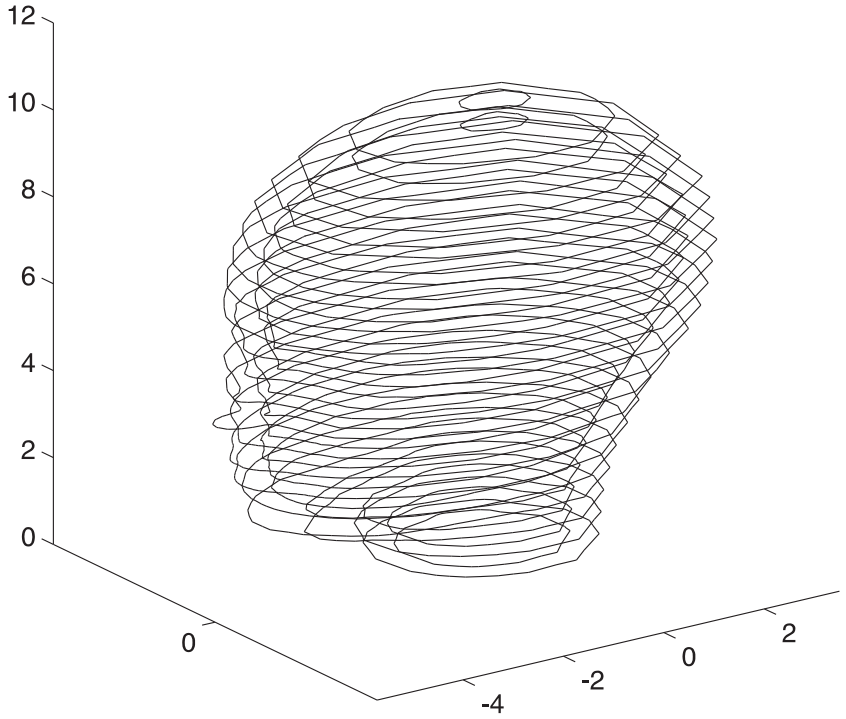
Figure 6.15 Solid model and STL model of the example part V of a human head



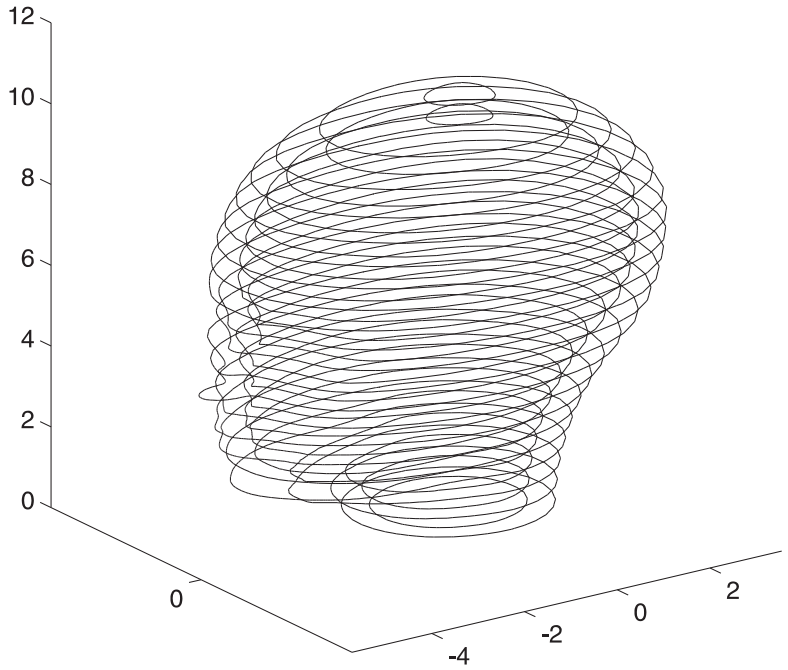
(b) Cross-sectional contours around the chin of the human head (z = 4.5) and their biarc curves

(b) Cross-sectional contours around the nose of the human head (z = 4.5) and their biarc curves

Figure 6.16 Cross-sectional contours of the example part V at two different cutting planes

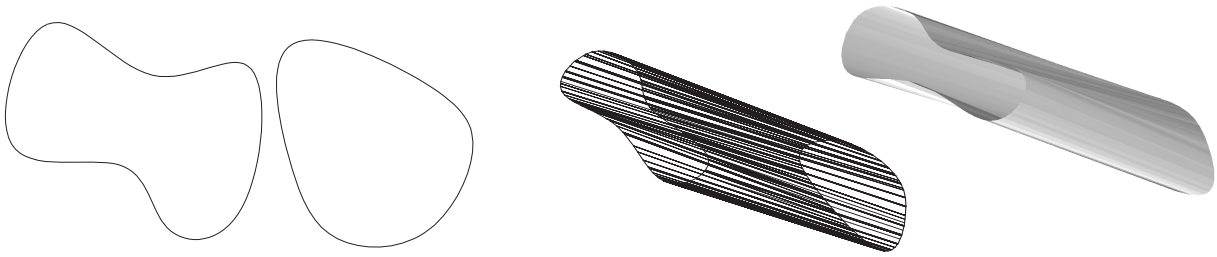


(a) Cross-sectional contours of the example part V, human head after the self-intersections and irregularities are removed

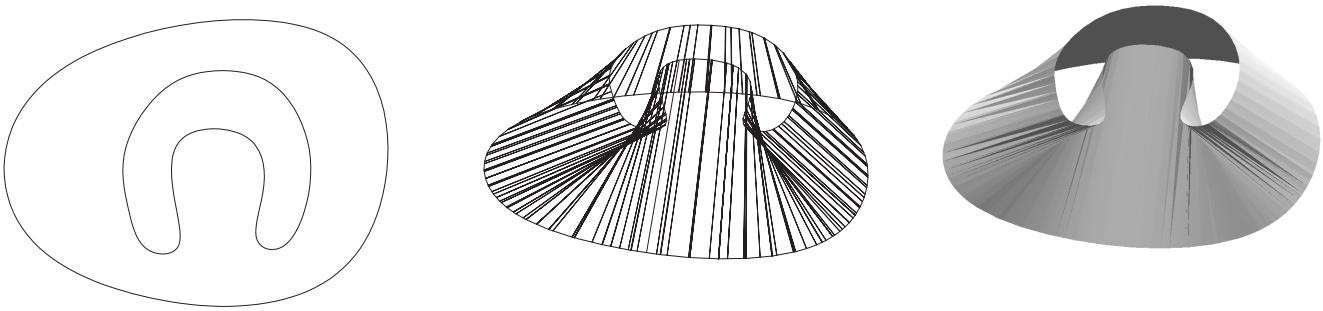


(b) The same cross-sectional contours after the biarc curve fitting

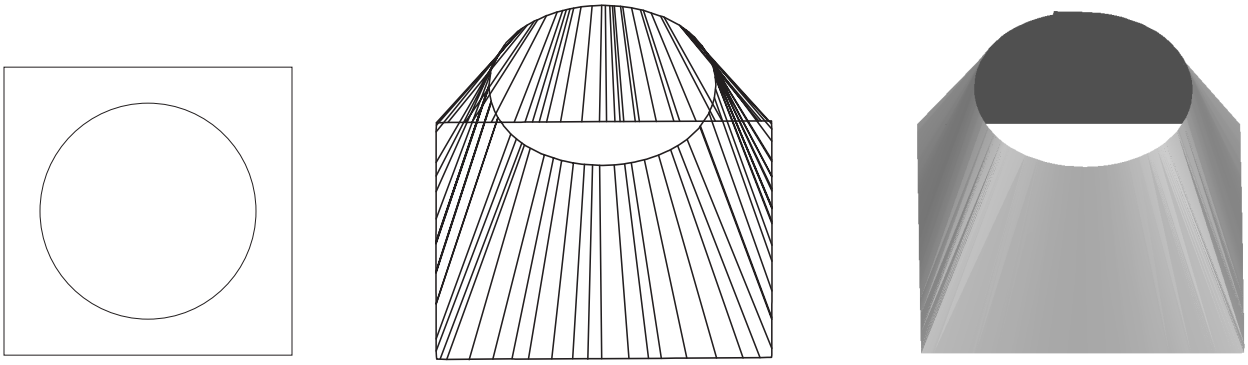
Figure 6.17 Slices of the generated hollowed part of the example part V, human head



(a) Two contours far a part (top view) and their ruled surface approximation (wireframe and solid model)

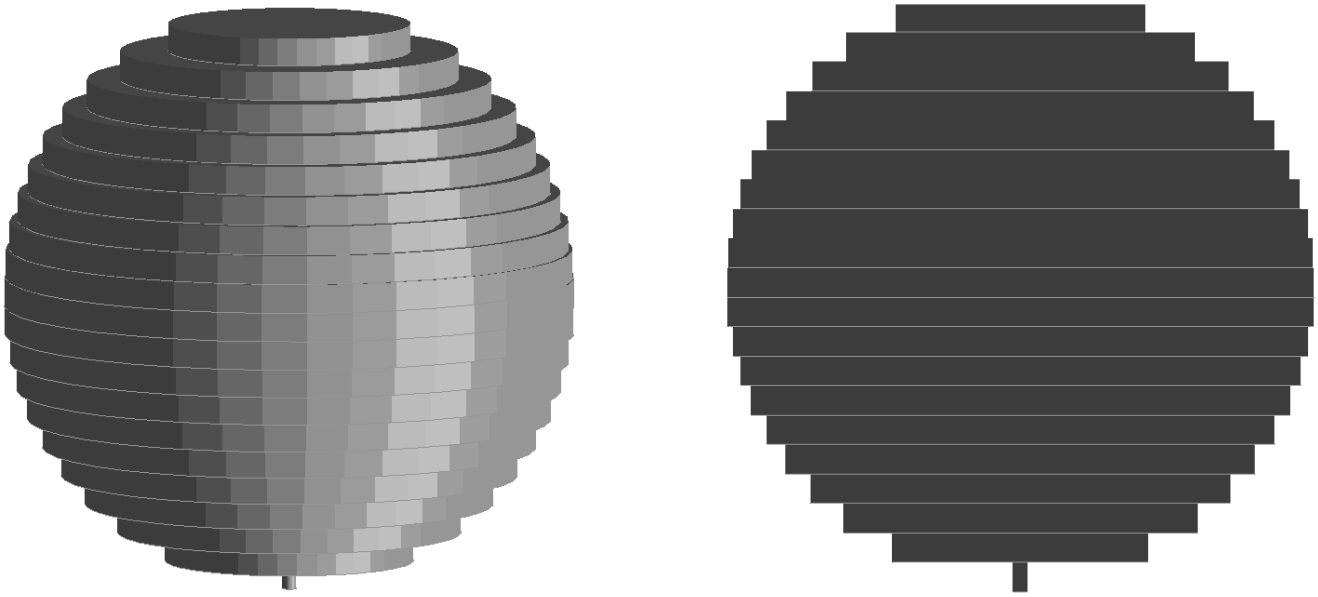


(b) Two contours with different shapes (top view) and their ruled surface approximation (wireframe and solid model)

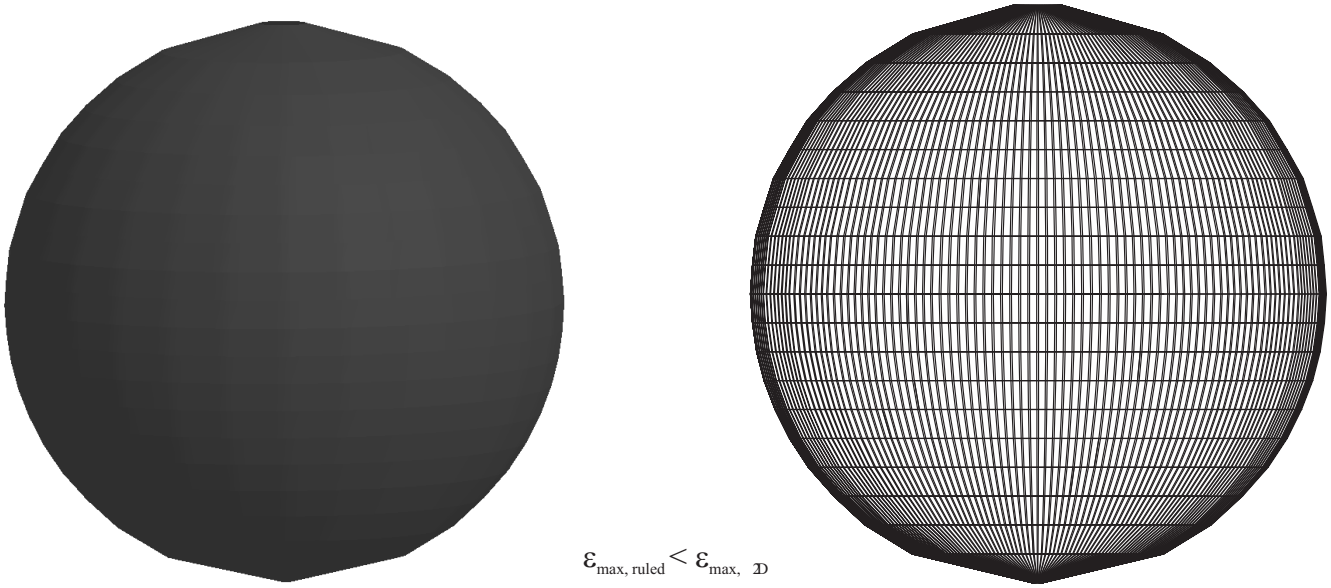


(c) Ruled surface approximated between a circle and a square

Figure 6.18 Examples of different contours and their ruled layer surface using the developed method



(a) Example part I approximated using traditional 2D layers
(surface error, $\varepsilon_{max,\ 2D}$=0.1520 for 20 layers)



$\varepsilon_{max,\ ruled} < \varepsilon_{max,\ 2D}$

(b) Example part I approximated using the proposed ruled layers method
(surface error, $\varepsilon_{max,\ ruled}$=0.0294" for 20 layers)

Figure 6.19 Example part IV approximated with 20 layers
(layer thickness = 0.15")

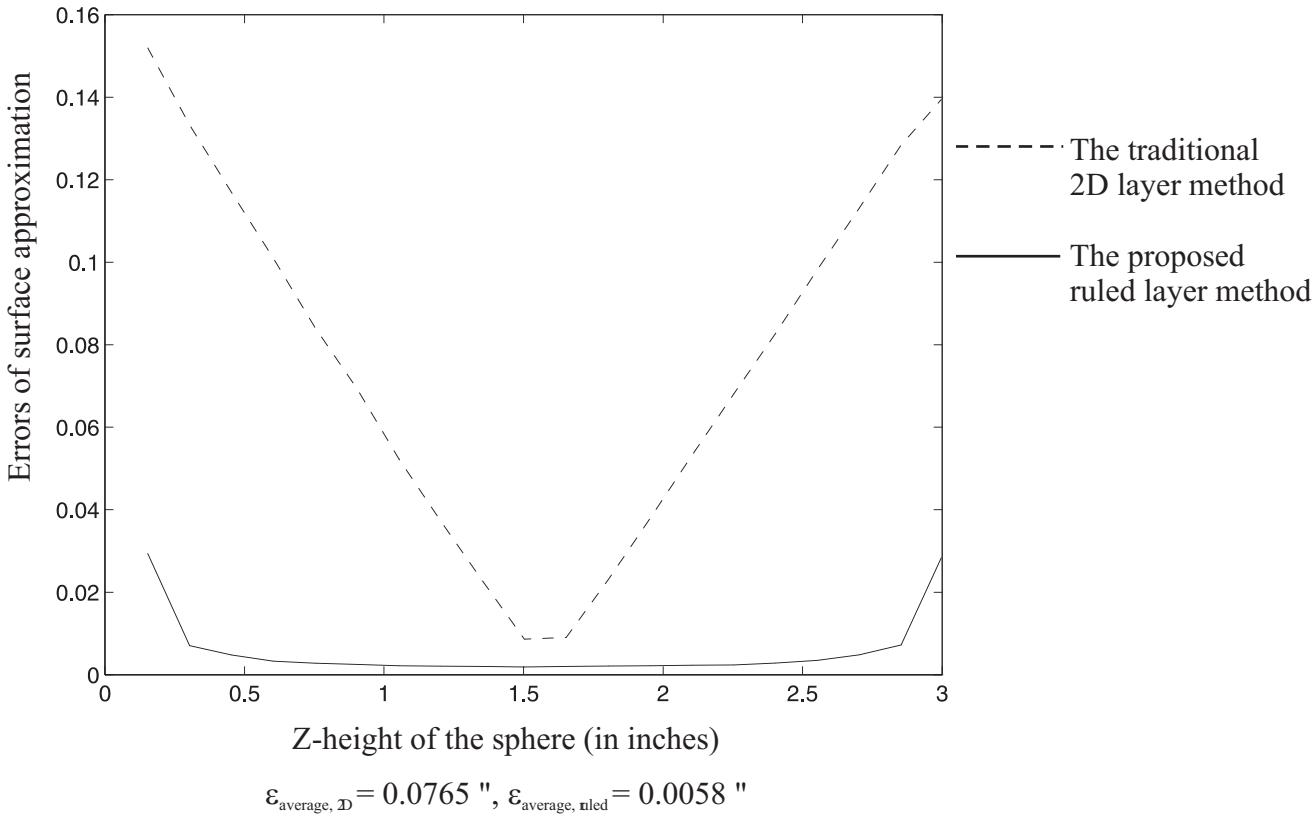


Figure 6.20 Comparing the maximum errors from the developed method and the traditional method for the layer thickness of 0.15" at different z-height of sphere

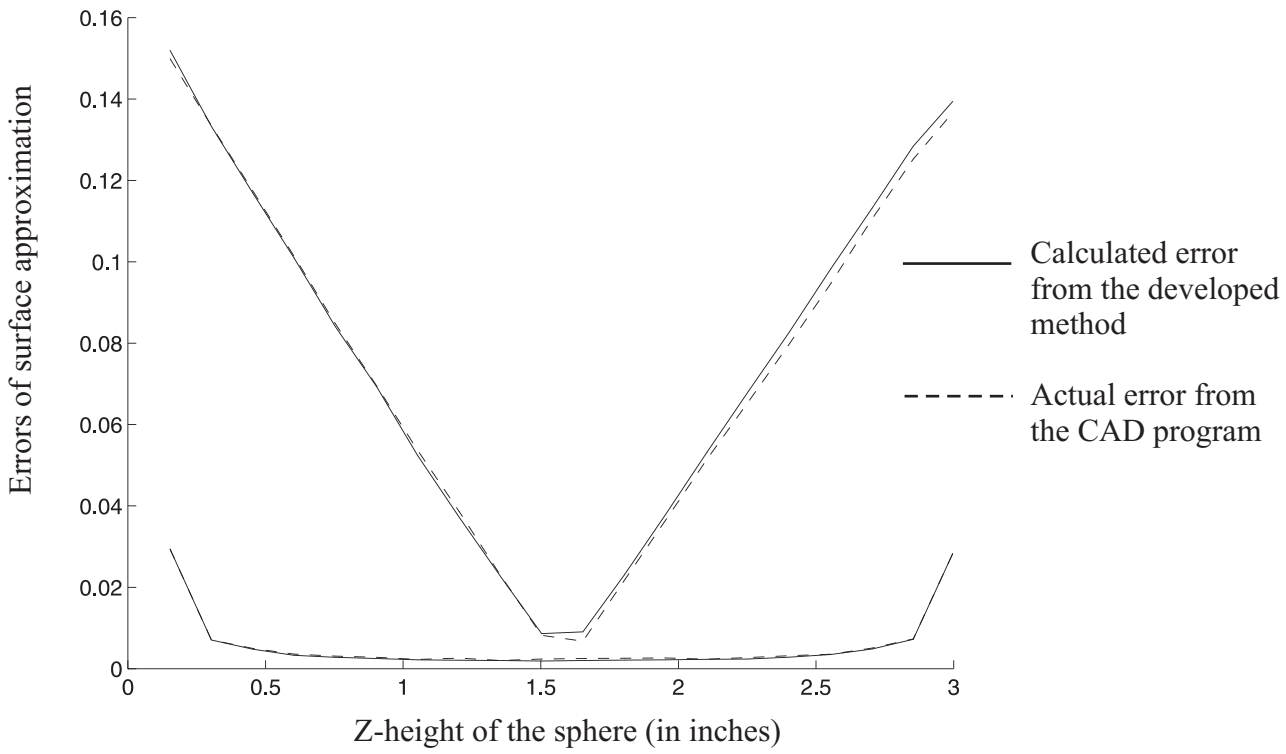


Figure 6.21 Comparing the calculated errors using the developed method and the actual errors using the CAD program's distance analysis module for both traditional 2D layer and ruled layer methods (layer thickness of 0.15")

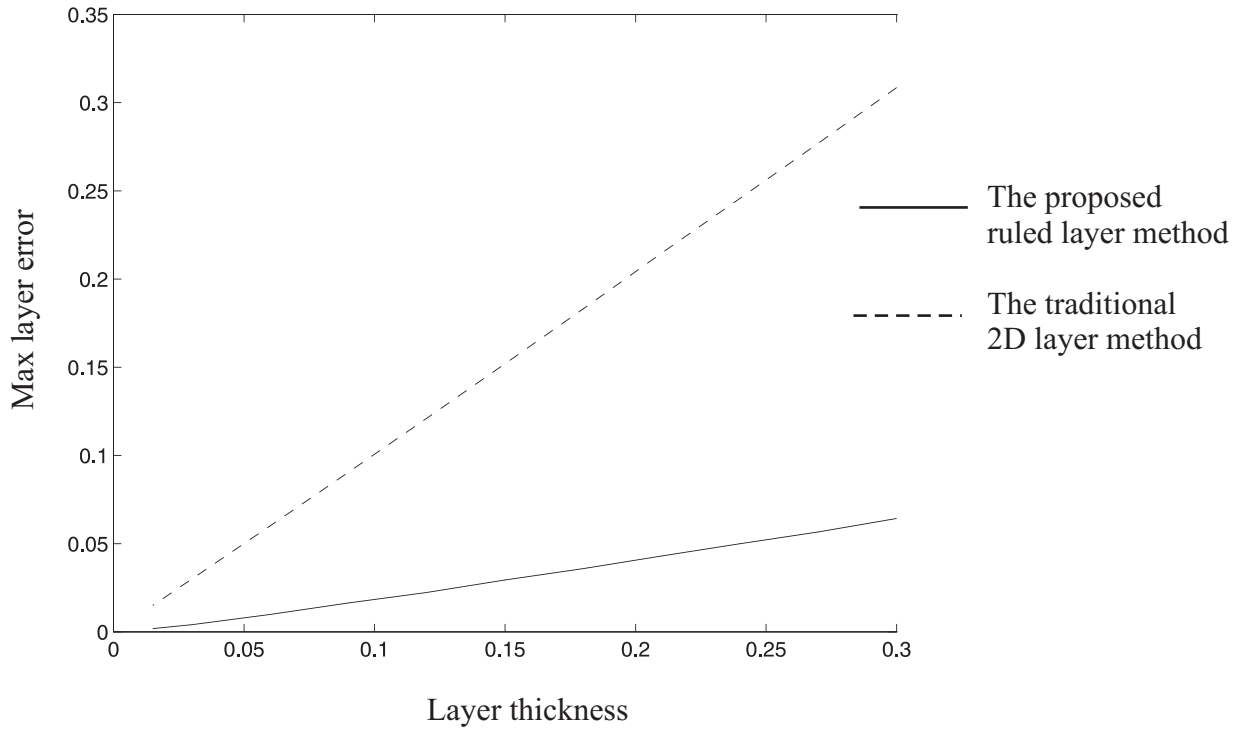


Figure 6.22 Comparing the maximum layer errors from the developed method and the traditional method for different layer thicknesses of the Example part IV