%%Curvature\_apical\_surface

clc;

clear all;close all;

%%%

Nro=1;%%load apical surface ApiC(cell number).mat

load(['ApiC' num2str(Nro) '.mat']);

load ('Tabla.txt');

%%%%%%%%%%%%%%

img=figure(1);

set(img, 'Position', [650 50 550 550]); %xc yc Tamx TamY

scatter3(Api(:,1), Api(:,2), Api(:,3),'.');hold on;

xlabel('X', 'FontSize', 12);

ylabel('Y', 'FontSize', 12);

zlabel('Z', 'FontSize', 12);

%%%%%%%%%sphereFit

[Center,Radius] = sphereFit(Api);

fig=figure (2);

[x,y,z] = sphere;% Make unit sphere

radius = Radius;

x = x \* radius;% Scale to desire radius.

y = y \* radius;

z = z \* radius;

set(fig, 'Position', [750 0 250 250]);

offset = Center;% Translate sphere to new location.

surf(x+offset(1,1),y+offset(1,2),z+offset(1,3),'FaceColor','none','EdgeColor','k');

hold on;

scatter3(Api(:,1),Api(:,2),Api(:,3),'.','r');

hold on;

xlabel('X', 'FontSize', 12);

ylabel('Y', 'FontSize', 12);

zlabel('Z', 'FontSize', 12);

axis equal;

Tabla(Nro,1)=Radius;

Tabla(Nro,2:4)=Center;

dlmwrite('Tabla.txt',Tabla,'\t');

%%%%%%%%%%%%%%

function [Center,Radius] = sphereFit(X)

% this fits a sphere to a collection of data using a closed form for the

% solution (opposed to using an array the size of the data set).

% Minimizes Sum((x-xc)^2+(y-yc)^2+(z-zc)^2-r^2)^2

% x,y,z are the data, xc,yc,zc are the sphere's center, and r is the radius

% Assumes that points are not in a singular configuration, real numbers, ...

% if you have coplanar data, use a circle fit with svd for determining the

% plane, recommended Circle Fit (Pratt method), by Nikolai Chernov

% http://www.mathworks.com/matlabcentral/fileexchange/22643

% Input:

% X: n x 3 matrix of cartesian data

% Outputs:

% Center: Center of sphere

% Radius: Radius of sphere

% Author:

% Alan Jennings, University of Dayton

A=[mean(X(:,1).\*(X(:,1)-mean(X(:,1)))), ...

2\*mean(X(:,1).\*(X(:,2)-mean(X(:,2)))), ...

2\*mean(X(:,1).\*(X(:,3)-mean(X(:,3)))); ...

0, ...

mean(X(:,2).\*(X(:,2)-mean(X(:,2)))), ...

2\*mean(X(:,2).\*(X(:,3)-mean(X(:,3)))); ...

0, ...

0, ...

mean(X(:,3).\*(X(:,3)-mean(X(:,3))))];

A=A+A.';

B=[mean((X(:,1).^2+X(:,2).^2+X(:,3).^2).\*(X(:,1)-mean(X(:,1))));...

mean((X(:,1).^2+X(:,2).^2+X(:,3).^2).\*(X(:,2)-mean(X(:,2))));...

mean((X(:,1).^2+X(:,2).^2+X(:,3).^2).\*(X(:,3)-mean(X(:,3))))];

Center=(A\B).';

Radius=sqrt(mean(sum([X(:,1)-Center(1),X(:,2)-Center(2),X(:,3)-Center(3)].^2,2)));