Data Transfer Between 2 Geometries

1. Introduction

In this report the data transfer from the Auckland geometry with 256014 nodes to the Bratislava geometry with 502 nodes using UNISYS and interpolation is explained. UNYSYS is a software to obtain 2-D bullseye plot of the heart potentials from 3-D data. To obtain the bullseye plot, UNISYS first applies translation and rotation to the geometry to get the geometry to certain orientation. Then we apply shifting and scaling so that the geometries are perfectly on top of each other. Then we apply interpolation to transfer data from one geometry to the other. The process can be applied to transfer data between 2 epi or 2 epi-endo geometries.

2. Steps

2.1 Translating and Rotating Geometries Using UNISYS

To translate and rotate the Auckland and Bratislava geometries to get them in the same orientation, we first run the code 'UNISYS_transrot' with the following structures:

geom.vertices: N X 3 matrix
geom.faces: M X 3 matrix

Then UNISYS requires the user to define the most apical point of the geometry and two other points to define the plane passing through the LV/RV division. After choosing each point we press space. Then it asks the user which side of the geometry is LV. The selection of the most apical point of the geometry is given in Figure 1 and selection of 2 other points to define the septum is given in Figure 2.

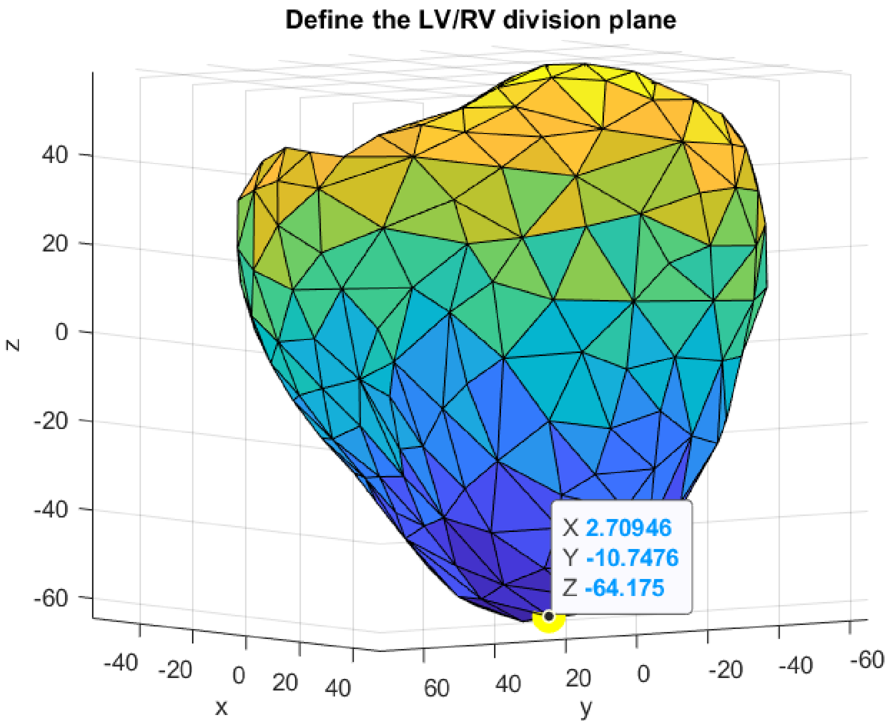

Figure 1. Choosing the most apical point of the geometry.

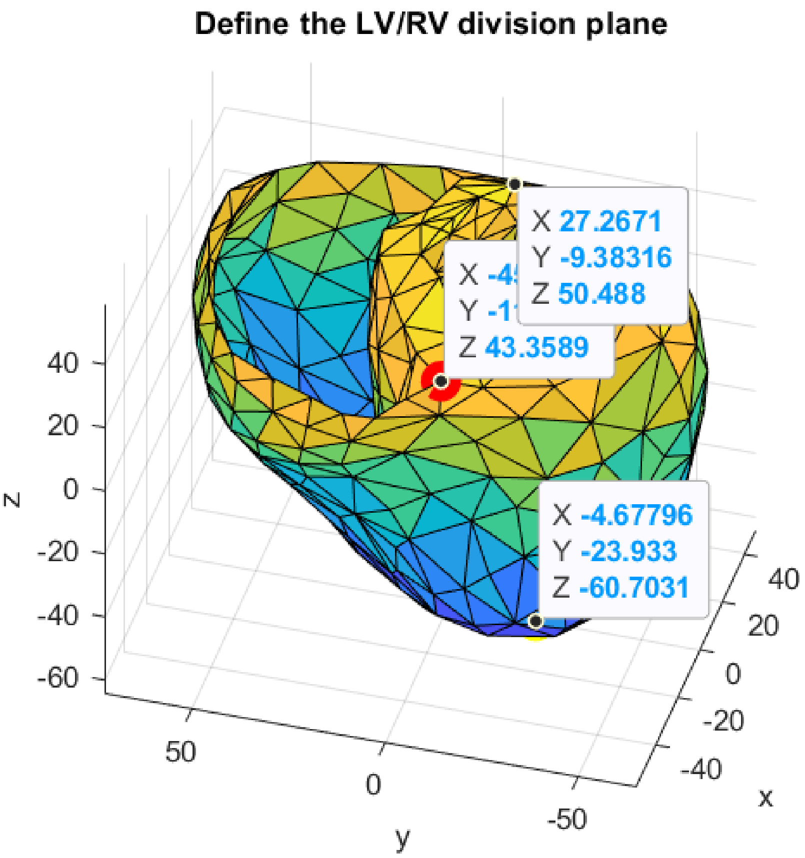

Figure 2: The appearance of UNISYS where the user defines the LV/RV division plane by choosing 3 points on the geometry.

2.2 Shifting and Scaling the Geometries

After getting two geometries in the same orientation, we shift and scale the geometries so that the geometries are perfectly on top of each other. To do this we run the "shift_scale" code. The code finds the center of gravities of the geometries and shifts them to the origin. Then it calculates the distance of each point of the geometries to the origin and find the mean value of them. By scaling one geometry with the ratio of this mean values, we can obtain two geometries perfectly on top of each other as shown in Figure 3.

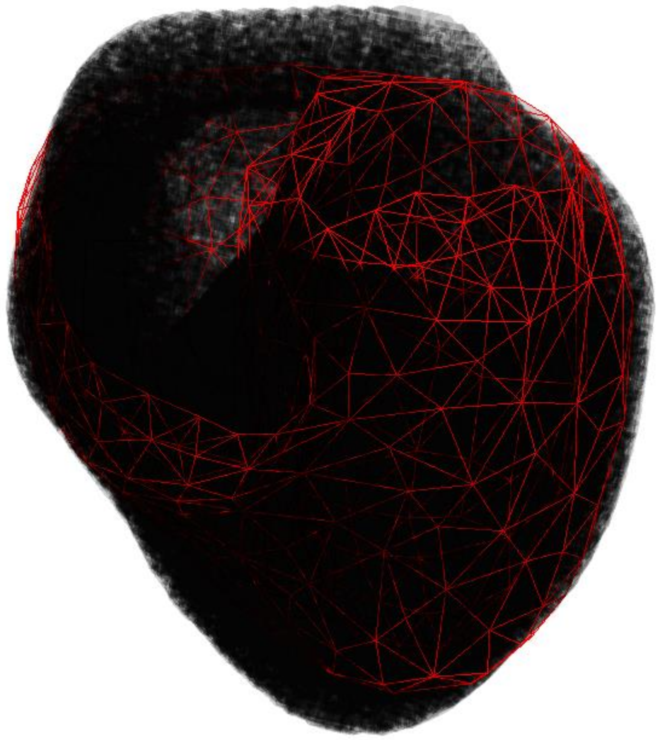

Figure 3: Two geometries on top of each other. The dense geometry is the Auckland geometry (black) and the sparse geometry is the Bratislava geometry (red).

2.3 Transferring Data Using Interpolation

After getting 2 geometries on top of each other we can transfer the data from one geometry to the other. To do this we run the function "interpolate" to use a simple interpolation method to transfer the data. Each node of the Bratislava geometry gets its data from the closest n nodes of the Auckland geometry. n is an input to the function and in this case n=50 is chosen. The weights are determined by their relative distance such that the closer node has more weight. The result of the data transfer is given in Figure 4.

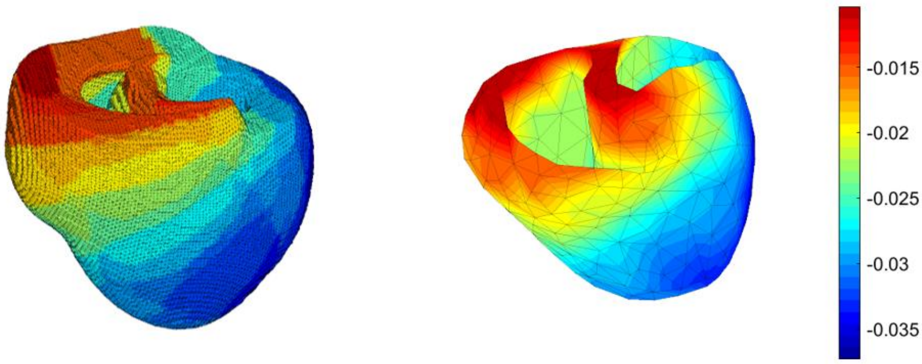

Figure 4. The original data on the Auckland geometry (left) and the transferred data on the Bratislava geometry (right).

3. Conclusion

When we observe the results, we conclude that the shapes of the epicardial potentiels match and we are successful in transferring the data. The above explained process can be used to transfer data between any 2 epi or 2 epi-endo geometries.