

A Method To Create The Deformed Purkinje Fibers

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1-Main Idea

The deformation of Purkinje fibers - the main concrete of the electrical system of the heart - is very complicated issue .In other words , as the heart undergoing any kind of deformation , the Purkinje fibers also deformed which means change of the position of bunch of nodes without changing the structure integrity of the whole system . This method which I used is very simple which circumvent several obstacles. First of all, I attach each node of Purkinje fibers with the most nearest point from ventricles ,then as the ventricles deformed ,the Purkinje fibers deformed ,but this deformation is very unique .To illustrate ,the Purkinje fibers structure must remain conserved to maintain its proper as well as genuine role.

2-Method Illustration

As in Fig-1 , I attach some of each Purkinje fibers nodes to the nearest ventricles nodes .The undeformed Purkinje fibers nodes are $p1...p6$,while the deformed one are $p'1...p'6$.Also the undeformed ventricles nodes are $N1..N4$,while the deformed one are $N'1...N'4$.As the the ventricles enlarge ,the Purkinje fibers will follow the same trend without deformation of its structure.As shown in fig 1 , the distance between any Purkinje fibers node and the nearest ventricles node remain constant even after the enlargement of the whole shape of ventricle.

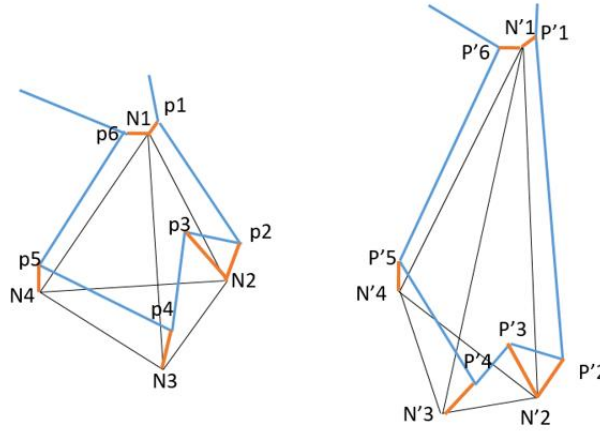


Fig 1 the elements of both deformed and undeformed Purkinje fibers in blue , the nodes of tetrahedron element represents the nodes of ventricles ,the orange lines represent the least distance between any Purkinje fibers node and nearest ventricle node.

The governing equation :

$$P(x, y, z) - N(x, y, z) = P'(x, y, z) - N'(x, y, z)$$

For Example I will consider the deformation of the two Purkinje fibers nodes $p1, p6$

$$P1x - N1x = P'1x - N'1x$$

$$P1y - N1y = P'1y - N'1y$$

$$P1z - N1z = P'1z - N'1z$$

$$P6x - N1x = P'6x - N'1x$$

$$P6y - N1y = P'6y - N'1y$$

$$P6z - N1z = P'6z - N'1z$$

3-RESULTS

First of all , I introduce deformed model of heart which is right ventricle deformed , the genuine shape of this one also presented in fig 2 .

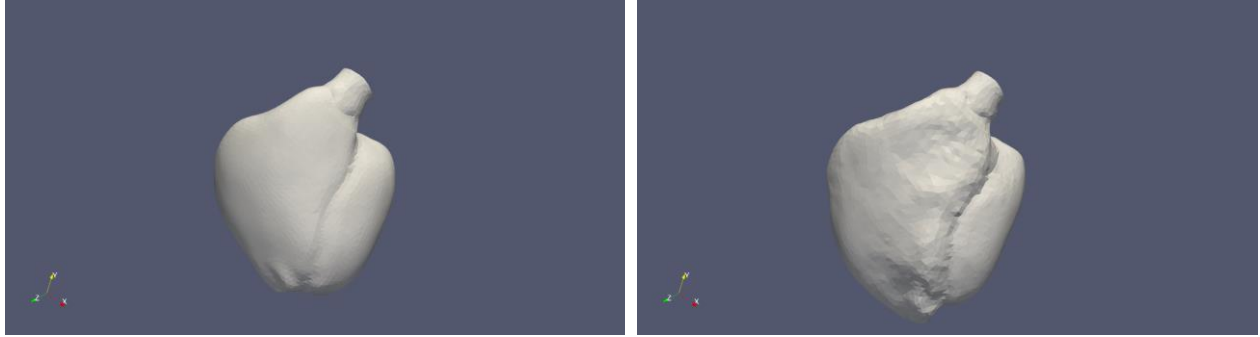


Fig 2 the undeformed heart on the left and the deformed heart on the right

Secondly , I show the Purkinje fibers deformed and undeformed in fig 3 ,then compare the two models the deformed and undeformed showing the adequacy of this method to describe the deformation of Purkinje fibers in fig 4 .

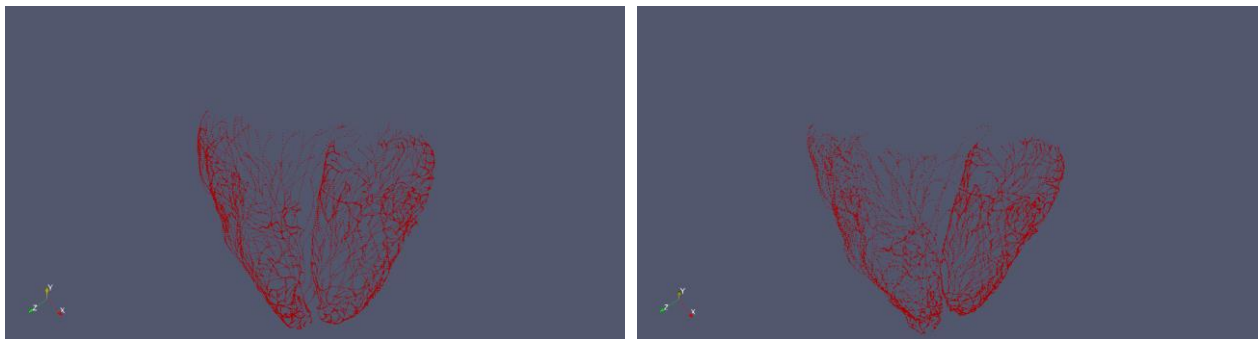


Fig 3 the deformed Purkinje fibers on the right and undeformed on the left

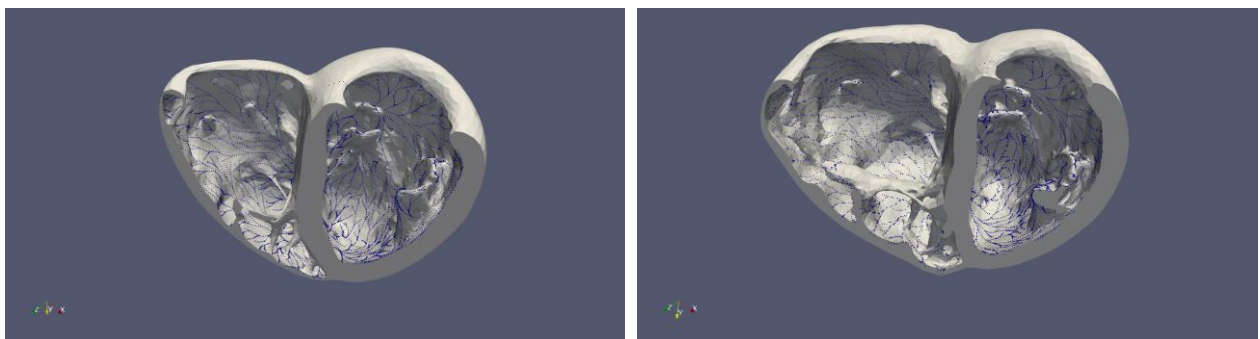


Fig 4 the deformed heart with deformed Purkinje fibers on the right and the undeformed heart with undeformed Purkinje fibers on the left