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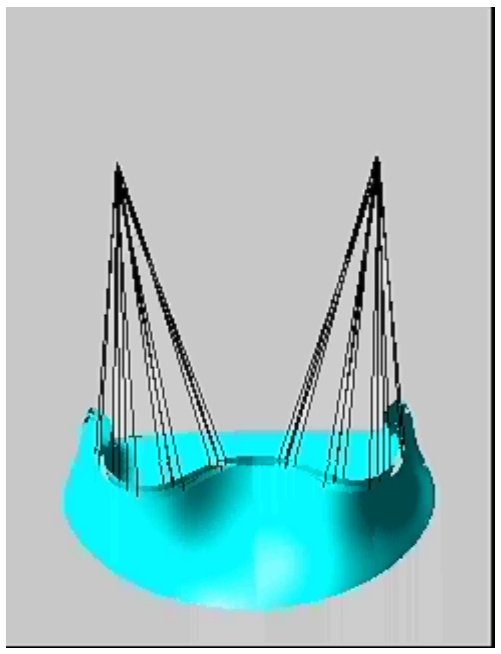

Dynamic modelling of chorded mitral valves inside left ventricle

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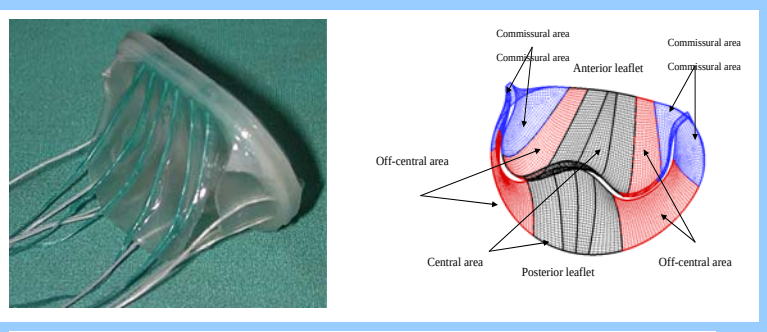
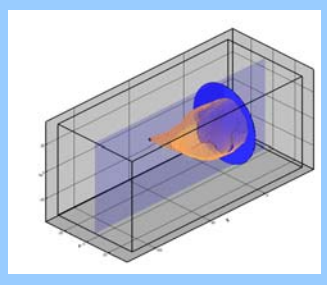
Project Outline

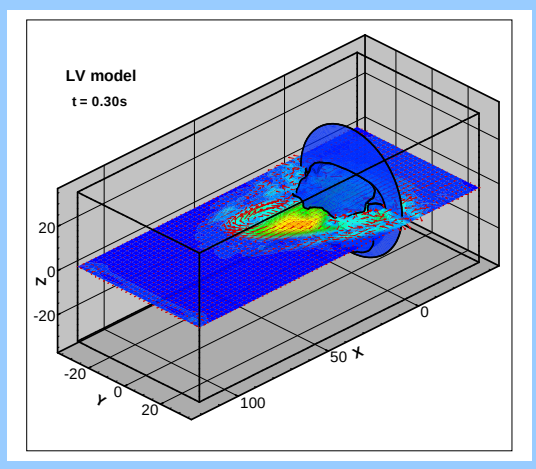
An Immersed Boundary fluid-structure interaction model is developed to investigate the dynamic behaviour of a designed prosthetic chorded mitral valve inside the moving left ventricle. In order to simulate more realistic physiological flow conditions, *in vivo* magnetic resonance images are used to determine the anatomical structure and the motion of the left ventricle. The ventricle geometry and its motion are incorporated into the dynamic mitral valve model. This model allows us to investigate the influences of the flow vortex generated by the LV motion on the mitral valve dynamics, as well as the impact of the motion of the chordae attachment points.



MV prosthesis used by the Glasgow group



Velocity vector plots of the left ventircle model at t=0.3sec for y-lane. Note the mitral valve is moving inside a contracting left ventricle..



Results show that the left ventricle motion and the induced complicated flow pattern increase the opening pressure gradient. They also make the valve motion strongly asymmetric and increase the valve stretch in the commissural areas. At the early rapid filling phase, the flow is featured by a strong jet, which impinges on the ventricle wall and swirls around in a clockwise fashion, forming a main clockwise vortex. This vortex persists through the remaining of the diastole phase. This is significantly different to the flow in the corresponding model put inside a tube, where the forward jet is accompanied by two vortices at each side.

References (downloadable from http://www.maths.gla.ac.uk/~xl):

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