

## **Regional dynamic strains of the native aortic valve**

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The native aortic valve undergoes complex deformations during the cardiac cycle. Understanding the movement of the native aortic valve will help to develop an accurate, robust and physiologically realistic numerical model capable of simulating tissue valve dynamics. A pulsatile flow loop that reproduces physiological aortic pressure is being used for quantifying the dynamic regional strain field of the aortic valve leaflets by tracking different markers placed in the areas of interest. A set of markers is applied to each leaflet in the areas of higher curvature and strains. Synchronized high speed (1000 fps) images for a complete cardiac cycle are taken with high digital speed cameras. Radial and tangential distortions are corrected. The coordinates of each marker are taken from each image and 3D reconstructed using the DLT method. From the resulting high-fidelity marker dynamic displacement data, strain maps were computed by using biquintic finite element (BQFE) method, which allows for computation of both the local strain and curvature tensors. The BQFE method is designed for surfaces undergoing large deformations and is appropriate for this study as the stress and strain distributions are highly sensitive to local surface geometry. Small angle light scattering (SALS) tests is also performed to study relation to local collagen fiber preferred direction and to correlate that orientation with the function of the fiber in the movement of the leaflet.