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Impact of robust image processing to reduce error in computational hemodynamics

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Mechanical properties of blood flow are common correlators to a wide variety of cardiovascular diseases. In this work variables to analyse and characterise the flow field and its relation with diseases are discussed in the context of cerebral aneurysms, reconstructed from in vivo medical imaging.

Medical images are susceptible to different sources of error and artefacts, which leads to image quality degradation and diminishes resolution. Image processing techniques are able to restore many of these downfalls and improve the post-processing and analysis. In this work anisotropic diffusion-filtering methods based on PDEs, and commonly used contrast enhancement methods are used to facilitate the segmentation of the vessel in the case of clinically acquired Rotational CT images and reduce possible geometry reconstruction errors and its propagations to the computational haemodynamics.

Results from simulations of Newtonian and non-Newtonian unsteady flow are performed using OpenFOAM, in anatomically accurate cerebral aneurysm geometries and a set of mechanical measures that can be related to diseased state, such as wall shear stress and derived measures, residence times and region of flow impingement, will be analyses and presented.

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