NUMERICAL SIMULATION OF SYMMETRIC BIFURCATIONS USING FLUENT

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Breathing is a vital function of the human body. Lung can be considered in a first approximation as a succession of airways bifurcations. In the region of the lung concerned by this study, the distance between successive bifurcations is short compare to the diameter, so the flow entering a bifurcation is still perturbed from the previous one. Consequently, present research is going toward multiple bifurcation models.

Previous work at the VKI involving PIV measurements as well as numerical simulation on double bifurcations has been done by C. Raick. But the numerical results show, on certain points, important differences with the experimental ones. The aim of the present work is to try to explain these differences and to give better understanding of the flow patterns in bifurcations through numerical simulation.

The influence on laser sheet misalignment during PIV measurement has been checked by off-plane post-processing of the numerical data. Accuracy of the PIV results have been checked using Signal to Noise Ratio plots. On a numerical point of view, the mesh independency as well as the solver and the computational domain independency has been checked.

Finally it was found that the boundary condition imposes an inlet mass flow rate different from the outlet mass flow rate. In addition, the inlet velocity profile corresponds to experimental measurements which are not totally representative of the real flow. Correcting these two points, a better agreement is found between the numerical and experimental results in the core and at the outer wall of the bifurcation. But the numerical results are still different from the experimental results concerning the velocity gradient at the inner wall of the bifurcation. A further investigation should be done to check the possibility of flow instabilities in this region.

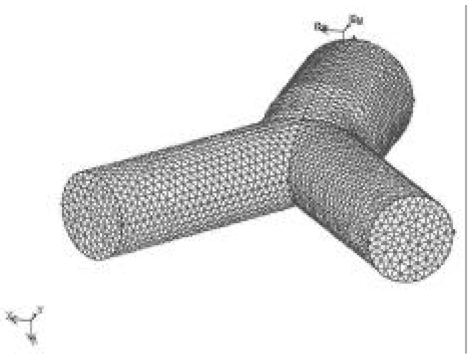

Figure 1: Unstructured mesh with coarse cell size

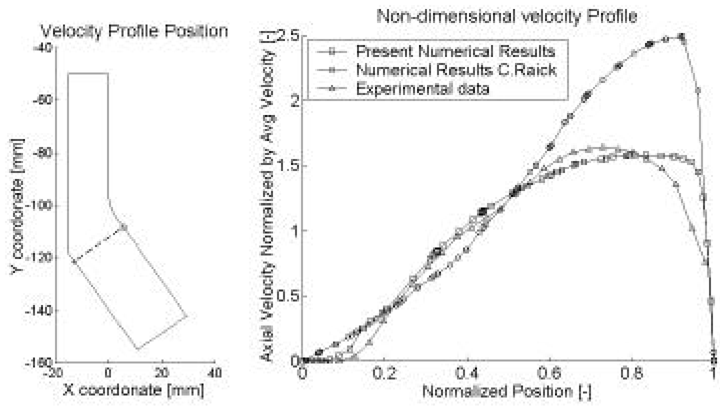

Figure 2: Velocity profile in symmetry plane