

Abstract Submitted
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Effect of the bifurcation angle on the flow within a synthetic model of lower human airways¹ ANDRES SANTIAGO ESPINOSA MORENO, CARLOS ALBERTO DUQUE DAZA, Universidad Nacional de Colombia — The effect of the bifurcation angle on the flow pattern developed during respiratory inhalation and exhalation processes was explored numerically using a synthetic model of lower human airways featuring three generations of a dichotomous morphology as described by a Weibel model. Laminar flow simulations were performed for six bifurcation angles and four Reynolds numbers relevant to human respiratory flow. Numerical results of the inhalation process showed a peak displacement trend of the velocity profile towards the inner walls of the model. This displacement exhibited correlation with Dean-type secondary flow patterns, as well as with the onset and location of vortices. High wall shear stress regions on the inner walls were observed for a range of bifurcation angles. Noteworthy, specific bifurcation angles produced higher values of pressure drop, compared to the average behavior, as well as changes in the volumetric flow through the branches. Results of the simulations for exhalation process showed a different picture, mainly the appearance of symmetrical velocity profiles and the change of location of the regions of high wall shear stress. The use of this modelling methodology for biomedical applications is discussed considering the validity of the obtained results.

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