

# Investigating the effect of stenosis severity on wall shear stress of an artery with pulsatile flow in OpenFOAM

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## Abstract

The objective of this project is to investigate the effect of stenosis severity on wall shear stress in an artery with pulsatile flow using the open-source CFD package OpenFOAM, and train a machine learning model to predict the severity based on the wall shear stress. Investigating the flow through stenosed geometry is important because of its connection to vascular diseases. Fig.1 shows the axisymmetric stenotic artery that was used in the present study; the severity of the geometry in the figure is 0.5. The geometry and mesh have been generated by using `blockMesh` utility. Blood flow in the artery is assumed as a Newtonian fluid, A `codedFixedValue` type boundary condition having a time-varying inlet velocity is provided at the inlet. Laminar flow in the geometry has been solved by using `pimpleFoam` solver. To obtain wall shear stress along the patches, the `wallShearStress` function has been used in the `controlDict` utility, and the results obtained were validated with the results available in the literature.

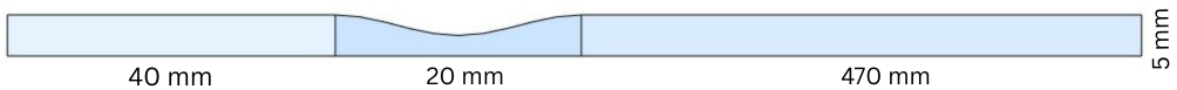


Figure 1: Geometry of plane channel

|                                  |   |
|----------------------------------|---|
| Length of upstream of stenosis   | 40 mm                                       |
| Length of stenosis               | 20 mm                                       |
| Length of downstream of stenosis | 470 mm                                      |
| Radius of artery                 | 5 mm  |
| Kinematic viscosity              | $3.267 \times 10^{-6} \text{ m}^2/\text{s}$ |
| Mean Reynolds number             | 200   |

Table 1: Geometrical parameters and fluid properties