

Flow over an inclined flat plate

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Abstract

The objective of this project is to numerically model incompressible turbulent flow over an inclined flat-plate structure of chord length 1 m and 3% thickness using OpenFOAM, and to study the aerodynamic effects. The angle of attack of the plate with respect to the flow is 30 degrees, and the corresponding Reynolds number of the flow based on the chord length is 150000. Numerical modeling is performed using the pisoFoam solver and $k-\omega$ SST turbulence model in OpenFOAM. The primary objective is to investigate the influence of the height of the flat plate above the ground on the flow characteristics and the aerodynamic forces acting on the plate. Furthermore, the effect of varying Reynolds numbers on the vortex shedding frequency is examined. The results obtained were compared with the experimental data from Fage and Johansen (1927). Details regarding geometry and flow has been listed in Table 1.

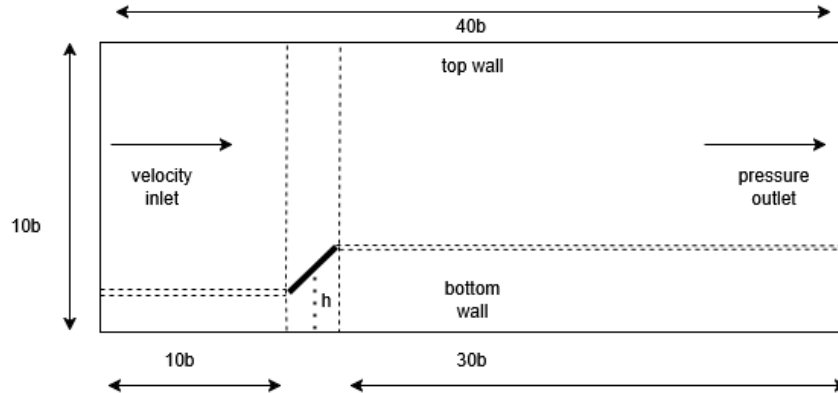


Figure 1: Computational domain diagram

Geometry details	Length of the domain = $40b$
	Height of the domain = $10b$
	Chord length of plate (b) = 1m
	Height of plate (h) = 1m
Fluid Property	Kinematic viscosity = $1.51e-05 \text{ m}^2/\text{s}$
Reynolds number based on chord length	$Re = 150000$
Turbulence model	$k-\omega$ SST
Solver	pisoFoam

Table 1: Details of geometry and flow conditions