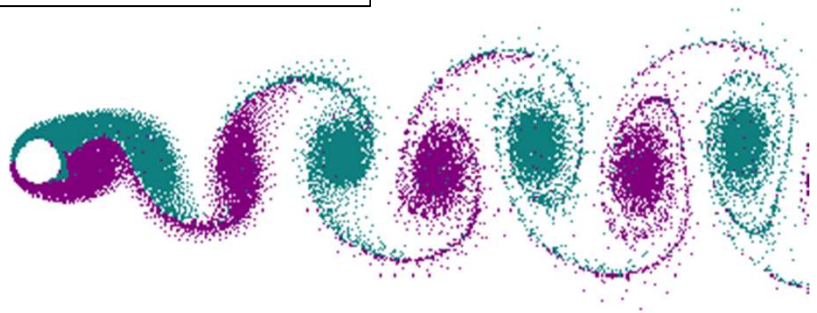
Course Project

Vortex Shedding Past Cylinder: Turbulence

- Objective :
    1. Analyse the flow around square cylinder
    2. Compare Fluent data with Lyin [1] experimental data.

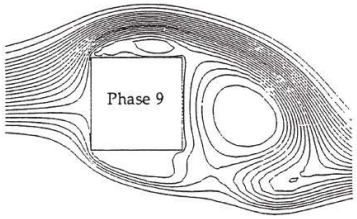


Vortex shedding past cylinder

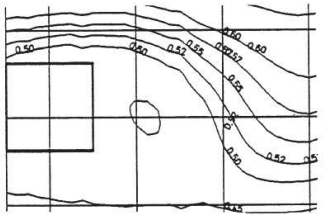
- Process and Methodology :
    1. Literature survey
    2. CFD simulation and Validation

- Results and Outcome:

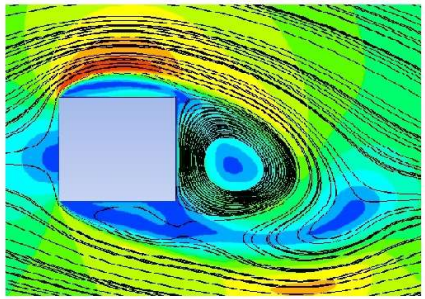
Flow Parameters	Experiment Value	Numerical Model
Reynolds Number	21400	21400
Free stream turbulence level	2%	2%
Strouhal number	0.132	0.131
Drag Coefficient	2.05-2.23	2.14
Working Fluid	Water	Water



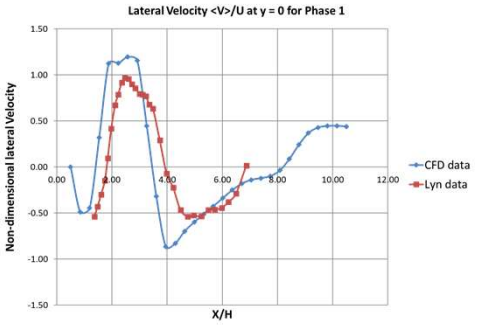
[A]

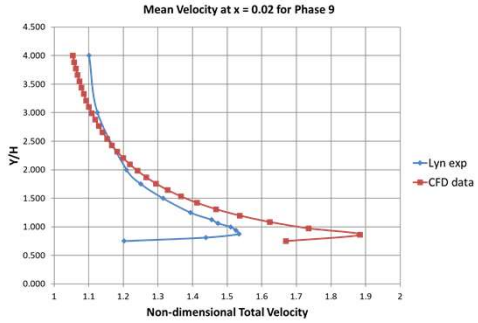


[B]



[C]

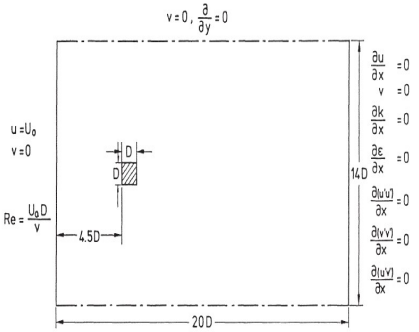




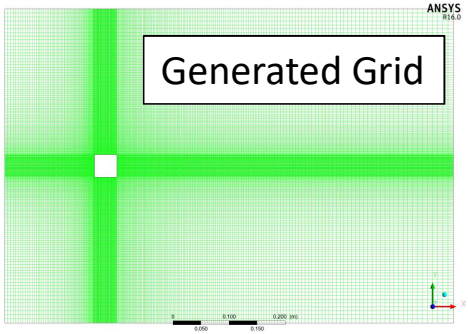
Flow Simulation and Grid Details

Simulation Details

Flow Parameters	Value
Reynolds Number	21400
Free stream turbulence level	2%
Strouhal number	0.132
Cylinder diameter	0.04 m
Working Fluid	Water



Generated Grid



Time Step Calculation

$$U = 0.5375 m/s$$

$$St = \frac{fD}{U}$$

$$f = \frac{St \cdot U}{D} = 1.77375 Hz$$

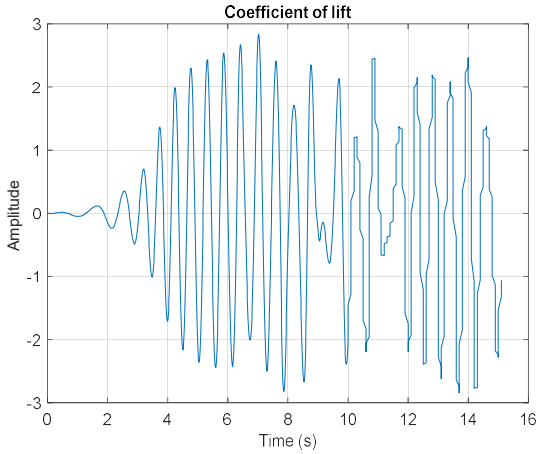
$$T = 0.563777 s$$

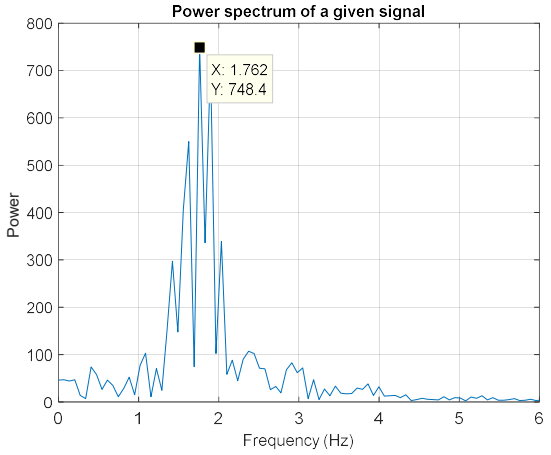
$$Step = 0.01 s$$

$$Iter / Step = 25$$

$$Total = 15 s$$

$$Iterations = 1500$$





- SST k-ω model has good behaviour in adverse pressure gradients and separating flow [5]
- Numerical C_d matches with experimental value
- 2D simulation model with FVM and SIMPLE algorithm for governing equations. [3]
- Second order implicit scheme for time discretization and third order scheme for spatial discretization.