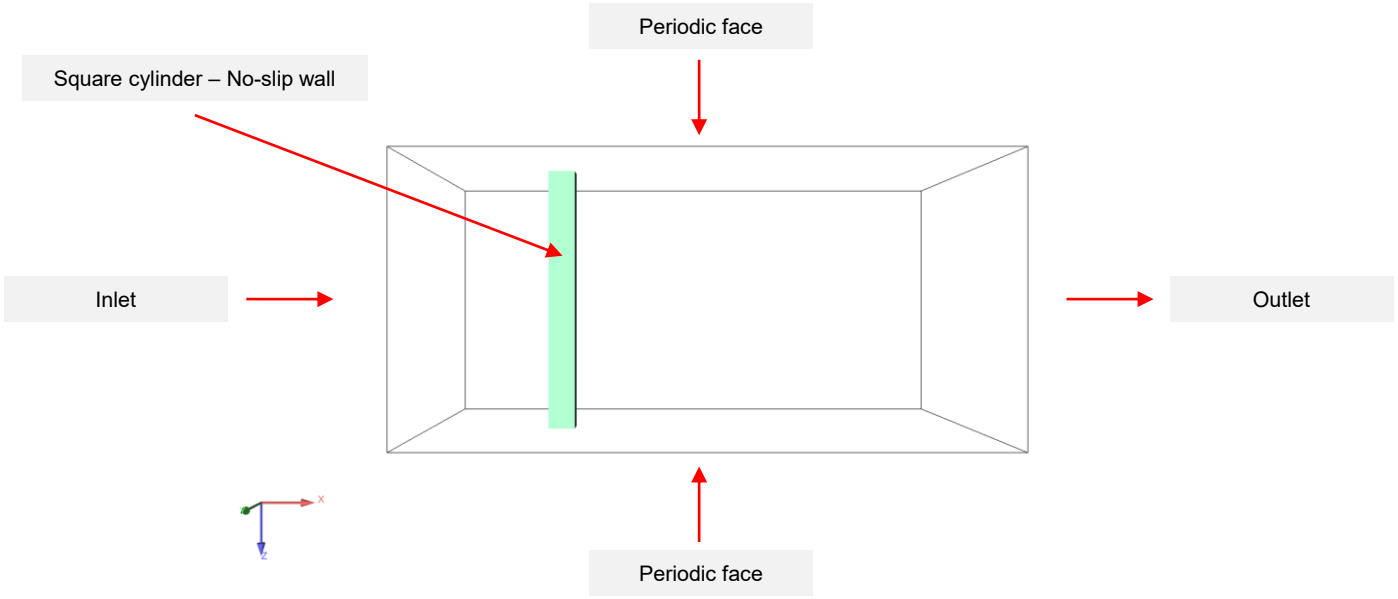
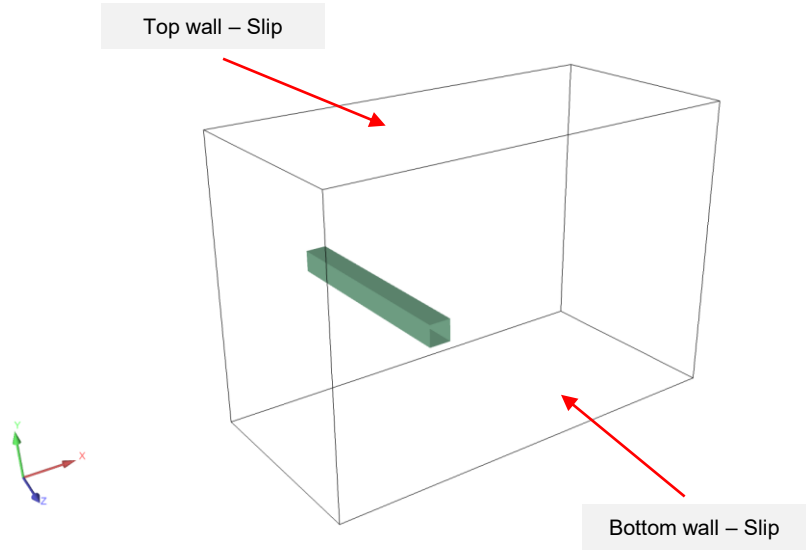
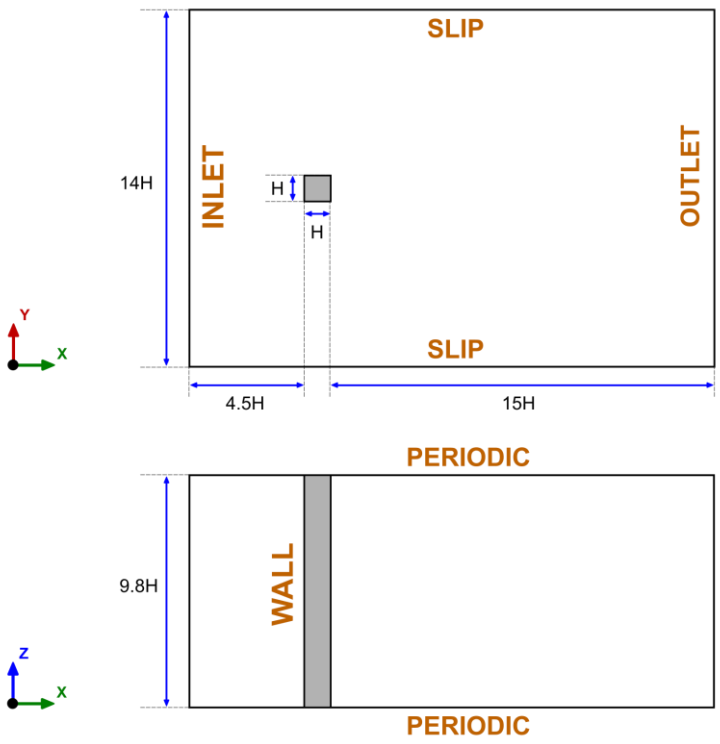
Square cylinder





Square cylinder



$$\mathbf{H} = 0.04\,m$$

$$\mathbf{U}_{in} = 0.535\,m/s$$

$$Re = 21400$$

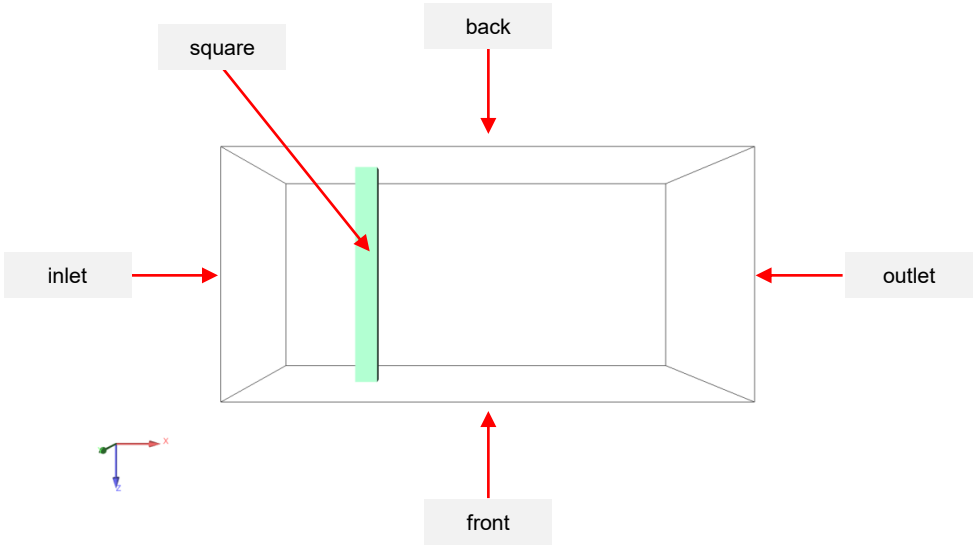
- Inlet velocity: 0.535 m/s
- Working fluid: water.
- Reference area to compute the force coefficients: 0.01568 m^2 (frontal area).
- Use SRS models – LES and DES.
- Initialize the solution starting from a RANS simulation.
- Interpolate the solution from a coarse mesh to a fine mesh.
- Do the standard post-processing and identify the vortical structures.
- Compute the integral length scales and ratio of integral length scale to grid length scale and determine the goodness of the mesh for a LES simulation (for the coarse and fine meshes).
- Sample the solution at different points and compute the turbulence energy spectrum.
- Compute the descriptive statistics of the time signal of the forces.
- Compute the shedding frequency and Strouhal number.
- Compute the flow statistics.
- Run with and without periodic boundary conditions and compare the outcome.

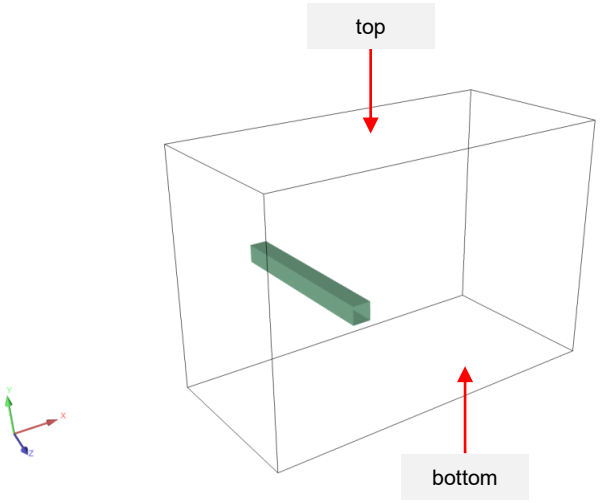
References:

D. A. Lyn and W. Rodi. “The flapping shear layer formed by flow separation from the forward corner of a square cylinder”. *J. Fluid Mech., 267, 1994.*
D. A. Lyn, S. Einav, W. Rodi, J. H. Park. "A laser-Doppler velocimetry study of ensemble-averaged characteristics of the turbulent near wake of a square cylinder". J. Fluid Mech., 304, pp. 285-319, 1995.

Square cylinder

- If you use the setting files to automatically setup the case, rename the boundary faces as follows:





- Rename the boundary faces before reading the setting file.
- The names are case sensitive.

Square cylinder

Validation data – A few results

Turbulence model	Drag coefficient	Strouhal number	Computing time (s)
Laminar	2.81	0.179	93489
LES	2.32	0.124	77465
DES	2.08	0.124	70754
SAS	2.40	0.164	57690
URANS (WM)	2.31	0.130	67830
URANS (WR)	2.28	0.135	64492
RANS	2.20	-	28246 (10000 iter)
Experimental values	2.05-2.25	0.132	-

Note: all simulations were run using 4 cores.

References:
Lyn, D.A. and Rodi, W., The flapping shear layer formed by flow separation from the forward corner of a square cylinder. *J. Fluid Mech., 267, 353, 1994.*
Lyn, D.A., Einav, S., Rodi, W. and Park, J.H., A laser-Doppler velocimetry study of ensemble-averaged characteristics of the turbulent near wake of a square cylinder. *Report. SFB 210 /E/100.*

Square cylinder