

3D AHMED-BODY FLOW at \$Re_H= 10000\$

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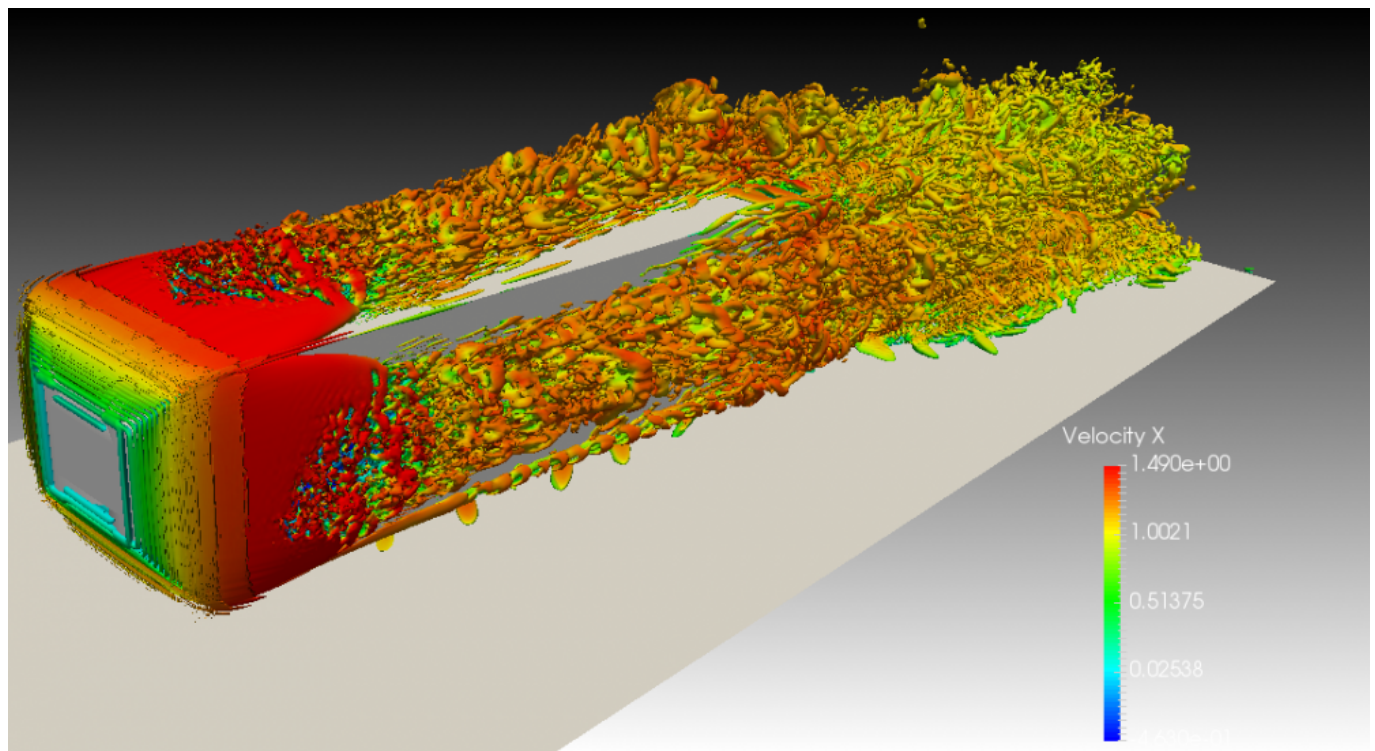
Date : July 2018

Simulation type : DNS ([Sunfluidh code](#))

Location : DATABASE_AHMEDBODY_RE10000_DNS

Status : Restricted access

Data size : ~ 609 Gb

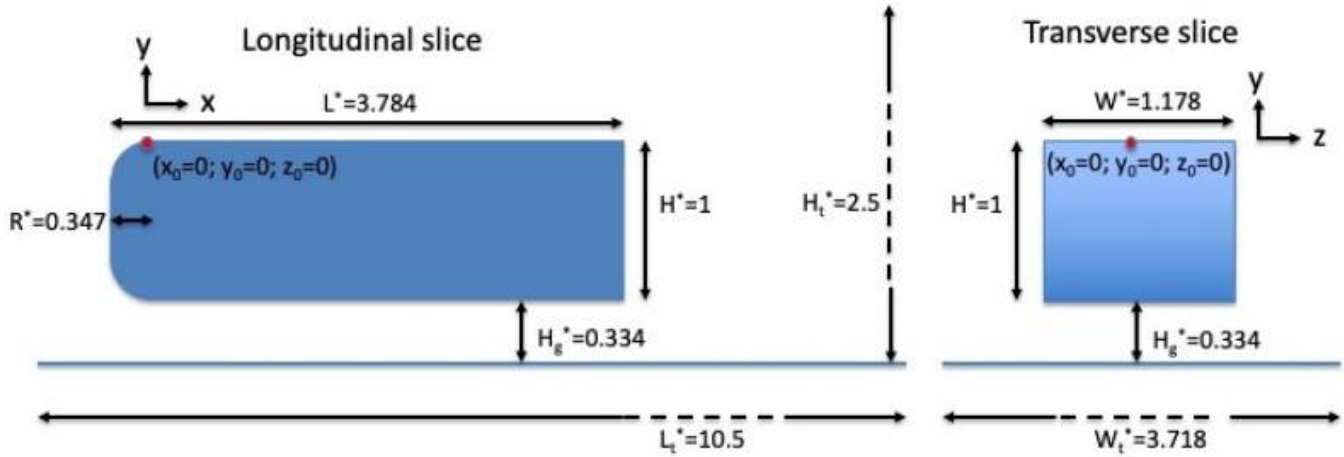


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Simulation settings

2D Sketch



Referential : cartesian geometry

1. axes :
 - x : downstream direction
 - y : normal direction
 - z : spanwise direction
2. origin :
 - $x_0 = 0$: upstream edge of Ahmed body top
 - $y_0 = 0$: Ahmed body top
 - $z_0 = 0$: mid-span of domain

Reference scales

- Density : mass density of the fluid (ρ_0)
- Length : Ahmed body height (H)
- Velocity : inlet bulk velocity (U_0)
- Dynamic viscosity : dynamic viscosity of the fluid (μ_0)
- Reynolds number : $Re_H = \frac{\rho_0 \cdot U_0 \cdot H}{\mu_0} = 10000$

Non-dimensionalised data

- velocity : $U^* = \frac{U}{U_0}$
- density : $\rho^* = \frac{\rho}{\rho_0} = 1$
- coordinates : $x^* = \frac{x}{H}$, $y^* = \frac{y}{H}$, $z^* = \frac{z}{H}$

Computational domain

1. **Domain scope**
 - Downstream direction(x) : $L_t^* = 10.5$
 - Normal direction (y) : $H_t^* = 2.5$
 - Spanwise direction (z) : $W_t^* = 3.718$
 - Ahmed body size : $L^* \times W^* \times H^* = 3.784 \times 1.178 \times 1$
 - Quarter rounded edges radius around the front face of the body : $R^* = 0.347$

- Ground clearance : $H_g^* = 0.334$

2. Boundary conditions

- Inlet : Uniform profile at $X_{in}^* = -1.0$
- Outlet : Orlansky's type at $X_{out}^* = 9.5$
- Wall conditions : Ahmed body, top and low walls of the domain
- Symmetry : lateral ends of the domain

3. Spatial resolution :

- Grid : $512 \times 256 \times 256$ (33.554.432 cells)
- About cell-size
 - $\Delta x_{min}^* = 1 \times 10^{-2}$ quad $\Delta x_{max}^* = 3.03588 \times 10^{-2}$ (downstream direction)
 - $\Delta y_{min}^* = 2 \times 10^{-3}$ quad $\Delta y_{max}^* = 4.12564 \times 10^{-2}$ (normal direction)
 - $\Delta z_{min}^* = 2 \times 10^{-3}$ quad $\Delta z_{max}^* = 4.59486 \times 10^{-2}$ (spanwise direction)

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Data features

• Time series from probes

- Physical quantities : velocity components along x, y and z directions (u,v,w) and pressure (p)
- 3 probes
- Time step = 5.5×10^{-3} time unit
- Time range : 71 to 303, 343 to 680, 680 to 729, 729 to 780 time units
- Locations (In horizontal mid-plan of the body wake)
 - $X_i = 4.384$, $X_j = -0.5$, $X_k = 0.3$
 - $X_i = 4.384$, $X_j = -0.5$, $X_k = 0.0$
 - $X_i = 4.384$, $X_j = -0.5$, $X_k = -0.3$
- File name (per physical quantity): $x_ins_00000.d$ with $x = u, v, w, p$

• 3D snapshots

- Instantaneous fields : velocity components along x,y and z directions (U,V,W) and pressure (P)
- Recording rate : 0.5 time unit
- Time range from 185 to 780 time units
- File name : $res_xxxxx_yyyyyy.d$ (xxxxx : MPI subdomain ID, yyyyyy : Time ID)
 - MPI subdomain ID = 0 (No domain decomposition)
 - Time ID : 178 to 1364

• Statistics

- fields : (i,j : indexes of direction x, y or z)
 - Mean fields of velocity components ($\langle U_i \rangle$) and pressure ($\langle P \rangle$)
 - Mean fields of quadratic quantities ($\langle P^2 \rangle$, $\langle U_i U_j \rangle$)
- Time startup = 43 time units
- Time range per file = 10 time units
- Total time range from 43 to 780 time units

- file name : rst_XXXXX_yyyyyyy.d (XXXXX : MPI subdomain ID, yyyyyyy : Time ID)
 - MPI subdomain ID= 0 (No domain decomposition)
 - Time ID : 1 to 73

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Database organisation

Data size : ~ 802 Gb

Main directory :

/vol/DATABASE_MECA/RESTRICTED_ACCESS/DATABASE_AHMEDBODY_RE10000_DNS

For more details about files, see the [wiki doc of Sunfluidh](#)

Directories & files

```
/GRID : contains all files about grid setup
input data file      : data_meshgen.d
report on grid features : report_meshgen.d
grid files for sunfluidh: maillx.d, mailly.d, maillz.d
check files (ASCII)   : check_mesh_I.d, check_mesh_J.d, check_mesh_K.d
                        (3 columns : indices, cell-face coordinates,
cell size)
/DATASETUP           : it contains input data file for sunfluidh : input3d.dat
/TIMESERIES          : contains time series recorded from probes
/TIMESERIES_T071-305 : from time= 71 to 303 time units
/TIMESERIES_T343-533 : from time=343 to 533 time units
/TIMESERIES_T533-638 : from time=533 to 638 time units
/TIMESERIES_T638-680 : from time=638 to 680 time units
/TIMESERIES_T680-729 : from time=680 to 729 time units
/TIMESERIES_T729-780 : from time=729 to 780 time units
      ASCII files : x_ins_00000_full.d with x= u,v,w,p
      also contains the space-averaged kinetic energy from
time=326 to 561 (time step : 2.55D-02)
      ASCII file : space_averaged_ke.d
/SNAPSHOTS          : snapshots binary files res_XXXXX_yyyyyyy.d
/STATISTICS         : statistics binary files rst_XXXXX_yyyyyyy.d
/RESTART_AR         : backup/restart archives save_t361.tar, save_t561.tar,
save_t638.tar, save_t729.tar, save_t780.tar
      contains any file to resume the simulation at time = 361,
561, 638, 729 and 780 time units
/FROM_COMPUTATION   : regroup some directories and files related to the
simulation
/SLICES             : slices ... not documented (old study)
      Binary files : plan_id_dir_XXXXX_yyyyyyy.d
      (nn : slice ID, dir : orientation, XXXXX : MPI subdomain ID,
```

yyyyyyy : Time ID)

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