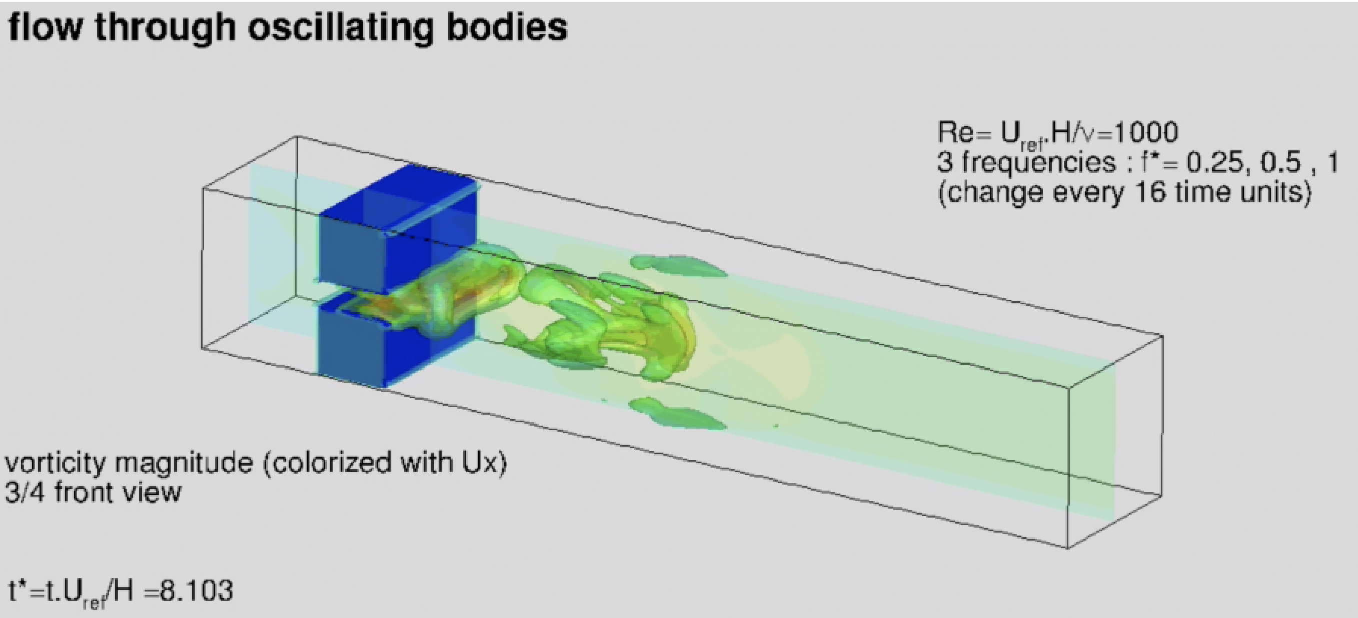
3D planar jet through oscillating bodies $Re_{H}= 1000$

The motion of bodies is vertical and forced with a sinusoïdal function
Three different frequencies are considered

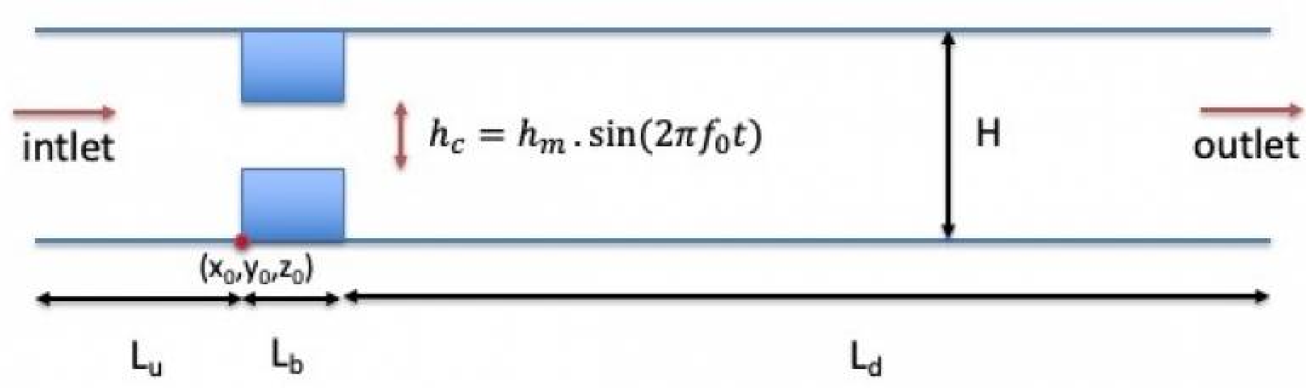
Author : Y. Fraigneau CNRS-LIMSI (yann.fraigneau@limsi.fr)
Date : April 2019
Location : DATABASE_JET_TROUGH_OSCILLATING_BODIES_DNS
Simulation type : DNS (Sunfluidh code)



Come back to first page

Simulation settings

2D sketch



Referential : cartesian geometry

1. axes :
    - x(i) : downstream direction
    - y(j) : normal direction
    - z(k) : spanwise direction
2. origin :
    - $x_0= 0$: upstream edge of the oscillating bodies
    - $y_0= 0$: lower horizontal wall of the duct
    - $z_0= 0$: left vertical wall of the duct

Reference scales

- Density : mass density of the fluid (ρ_0)
- Length : duct height (H)
- Pressure : pressure variation between inlet and outlet, respectively ($\Delta P_0= P_i-P_o$)
- Velocity : velocity scale ($U_0=\sqrt{\frac{P_i-P_o}{\rho_0}}$)
- Dynamic viscosity : dynamic viscosity of the fluid (μ_0)
- Body oscillation frequency : f_0 , 3 frequencies are considered over the time range of the simulation ($f_0= 0.25 , f_0=0.50,f_0= 1.0 $)
- Reynolds number : $Re_H= \frac{\rho_0.U_0.H}{\mu_0}= 1000$
- Strouhal number : $St_0=\frac{H.f_0}{U_i}$

Non-dimensionalised data

- velocity : $U^*=\frac{U}{U_0}$
- pressure : $P^*=\frac{P}{\Delta P_0}$
- density : $\rho^*= \rho/\rho_0= 1$
- coordinates : $x*=\frac{x}{H}$, $y^*=\frac{y}{H}$, $z^*\frac{z}{H}$

Computational domain

1. **Domain scope**
    1. Duct
        - Downstream direction(x) : $L^*= 6.0$ (upward duct $L_u= 1$, downward duct $L_d=4.5$)
        - Normal direction (y) : $H^*= 1.0$
        - Spanwise direction (z) : $l^*= 1.0$
    2. Oscillating bodies (couple of parallelepiped bodies oscillating vertically in opposite phase)
        - Upstream edge position : $x_1=x_2= 0.0$
        - length (x): $L_b= 0.5$
        - height (y): Body's heights vary in regard to time t in such a way the clearance h_c between bodies evolves as $h_c= h_m*\sin(2\pi.f_0.t)$
        - width (z) : $l_z=1.0$
        - bodies are modeled with a pseudo-penalisation method (Pasquetti et al., Applied Numerical Mathematics, 2008)

2. **Boundary conditions**
    - Inlet : imposed pressure condition ($P_i=1$)
    - Outlet : imposed pressure condition ($P_o=0$)
    - Wall conditions : usual no-slip conditions on walls

1. **Spatial resolution**

- Regular grid : $180 \times 80 \times 40$ (576.000 cells)
- About cell-size
    - $\Delta x*= 0.0333$ (downstream direction)
    - $\Delta y*= 0.0125$ (normal direction)
    - $\Delta z*=0.0250$ (spanwise direction)

Come back to first page

Data Recording : information about data types

- **3D snapshots**
    - Instantaneous fields : velocity components in x, y and z directions (U,V,W), the pressure (P) and the phase function related to the body motions (TRACE)
    - Recording rate : 0.05 time unit
    - Time range from from 0.0 to 100.0 time units
    - File name : res_xxxxx_yyyyyyy.d
        - MPI subdomain ID: 0
        - Time ID : from 1 to 2000

Come back to first page

Database organisation

Data size : ~ 24 Go
Main directory : /vol/DATABASE_MECA/DATABASE_JET_TROUGH_OSCILLATING_BODIES_DNS
For more details about files, see the the wiki doc of Sunfluidh

Directories & files

```
/DATASETUP       : ASCII files
 input data file for sunfluidh : input3d.dat
/SNAPSHOTS  : snapshots binary files res_xxxxx_yyyyyyy.d
```

Come back to first page

From:
https://datasetmeca.lisn.upsaclay.fr/ - **CFD DATABASE**

Permanent link:
https://datasetmeca.lisn.upsaclay.fr/doku.php?id=datasetmeca:jetoscillatingbodies&rev=1605716353

Last update: **2020/11/18 17:19**