

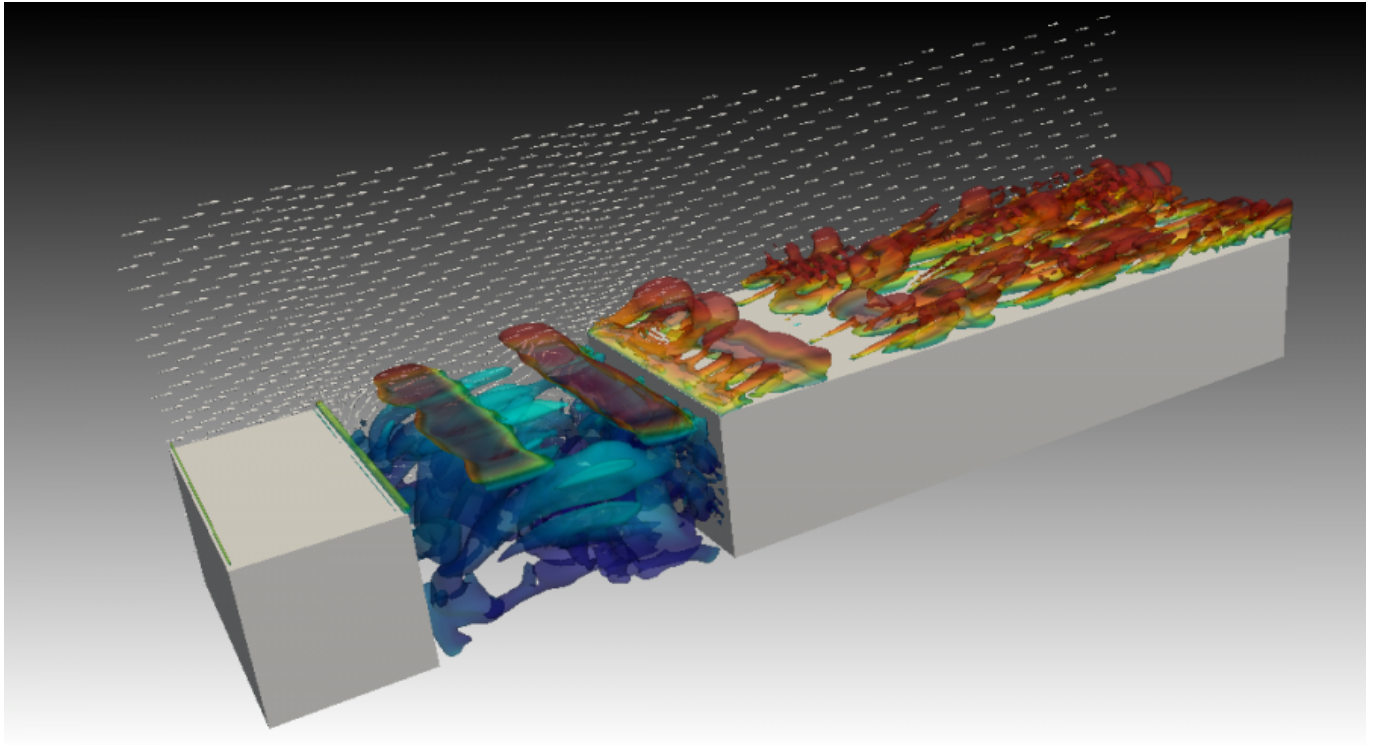
3D shear-layer driven cavity flow at $Re_{L_c} = 7826$

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Date : July 2020

Location : DATABASE_CAVITY3D_R2_RE7826_PER1.0_DNS/NOFORCINGTERM

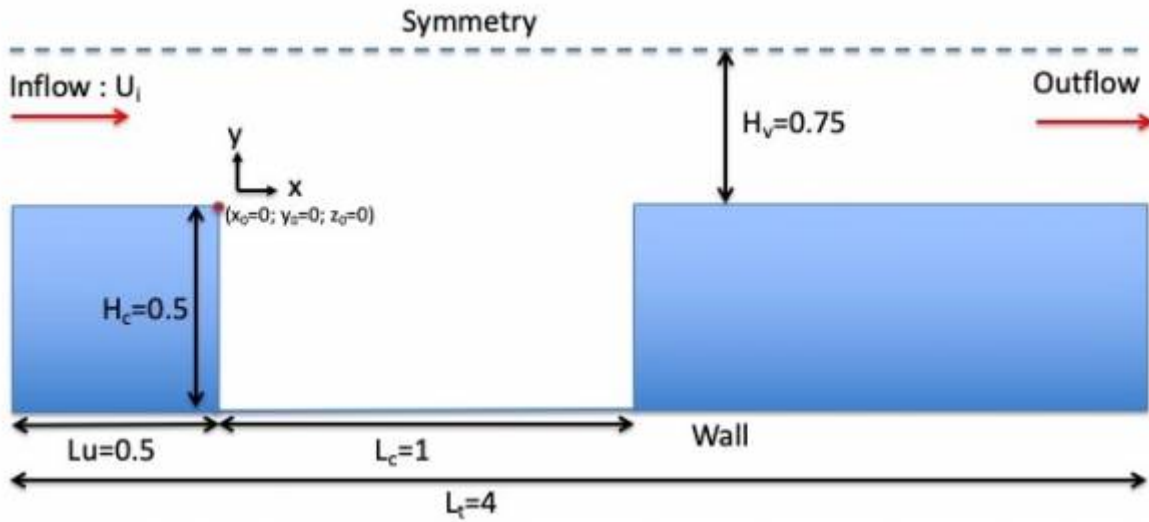
Simulation type : DNS ([Sunfluidh code](#))



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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 cavity
- $y_0 = 0$: upstream edge of the cavity
- $z_0 = 0$: upstream edge of the cavity, at the mid-span location

Reference scales

- Density : mass density of the fluid (ρ_0)
- Length : cavity length (L_c)
- Velocity : inlet bulk velocity (U_i)
- Dynamic viscosity : dynamic viscosity of the fluid (μ_0)
- Reynolds number : $Re_H = \frac{\rho_0 U_i L_c}{\mu_0} = 7826$

Non-dimensionalised data

- velocity : $U^* = \frac{U}{U_i}$
- 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) : $L^* = 4.0$
- Normal direction (y) : $H_t^* = 1.25$
- Spanwise direction (z) : $l^* = 1.0$
- upstream vein length : $L_u^* = 0.5$

- cavity height : $H_c^* = 0.5$

2. Boundary conditions

- Inlet : Blasius' profil at $X_{in}^* = -0.5$. Boundary layer thickness $\delta^* = 8.75 \cdot 10^{-2}$
- Outlet : Orlansky's type at $X_{out}^* = 3.5$
- Wall conditions : floor and cavity walls
- Periodicity : lateral ends of the domain (spanwise direction)
- Symmetry plan : top of the domain

3. Spatial resolution :

- Grid : $192 \times 128 \times 64$ per subdomain (1.572.864 cells over the domain)
- About cell-size
 - $\Delta x_{min}^* = 1.0 \cdot 10^{-2} \approx \Delta x_{max}^* = 3.96 \cdot 10^{-2}$ (downstream direction)
 - $\Delta y_{min}^* = 7.5 \cdot 10^{-3} \approx \Delta y_{max}^* = 1.45 \cdot 10^{-2}$ (normal direction)
 - $\Delta z_{min}^* = \Delta z_{max}^* = 1.5625 \cdot 10^{-2}$ (spanwise direction)

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Data Recording : information about data types

• Time series from probes

- Physical quantities : velocity components along x, y and z directions (u,v,w) and pressure (p)
- 11 probes
- Time step = 0.0525 time unit
- Time range : 25.02 to 259.96 time units
- Locations (In vertical mid-plan at $z=0.0$)
 - $X_i=0.2, X_j=-0.3, X_k=0.0$
 - $X_i=0.5, X_j=-0.3, X_k=0.0$
 - $X_i=0.8, X_j=-0.3, X_k=0.0$
 - $X_i=0.1, X_j=0.05, X_k=0.0$
 - $X_i=0.5, X_j=0.05, X_k=0.0$
 - $X_i=0.9, X_j=0.05, X_k=0.0$
 - $X_i=1.0, X_j=0.05, X_k=0.0$
- File name (per physical quantity) : $x_ins_yyyyy.d$ with $x = u,v,w,p$ and 'yyyyy' the MPI subdomain ID

• 3D snapshots

- Instantaneous fields : velocity components in x, y and z directions (U,V,W) and pressure (P)
- Recording rate : 0.25 time unit
- Time range from 210.0 to 260.0 time units
- File name : $res_xxxxx_yyyyyy.d$ (xxxxx : MPI subdomain ID, yyyyyy : Time ID)
 - MPI subdomain ID: 0
 - Time ID : from 39 to 239

• 2D slices

- Instantaneous fields : velocity components in x, y and z directions (U,V,W) and pressure (P)
- Recording rate : 0.05 time units
- Time range from from 210 to 260 time units
- File name : slice_n_idir_XXXXX_yyyyyyy.d (n : slice number ID, idir : normal orientation= 1: x(i), 2: y(j), 3: z(k), XXXXX : MPI subdomain ID, yyyyyyy : Time ID)
 - MPI subdomain ID: 0
 - Time ID : from 1 to 1001
- 8 slices
 - slice ID : 1 - normal orientation : spanwise - location : $z = -3.390625 \cdot 10^{-2}$
 - slice ID : 2 - normal orientation : spanwise - location : $z = -2.234375 \cdot 10^{-2}$
 - slice ID : 3 - normal orientation : spanwise - location : $z = -7.8125 \cdot 10^{-2}$
 - slice ID : 4 - normal orientation : spanwise - location : $z = 7.8125 \cdot 10^{-2}$
 - slice ID : 5 - normal orientation : spanwise - location : $z = 2.234375 \cdot 10^{-2}$
 - slice ID : 6 - normal orientation : spanwise - location : $z = 3.390625 \cdot 10^{-2}$
 - slice ID : 7 - normal orientation : normal - location : $y = -0.25$
 - slice ID : 8 - normal orientation : normal - location : $y = 0.03$
- **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 average computation
 - Time startup = 210.0 time units
 - Time range per file = 50.0 time units
 - Total time range from 180.0 to 510.0 time units
 - file name : rst_XXXXX_yyyyyyy.d (XXXXX : MPI subdomain ID, yyyyyyy : Time ID)
 - MPI subdomain ID : 0 (MPI process rank where results about space average computation are stored)
 - Time ID : 1

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Database organisation

Data size : ~ 7.8 Go

Main directory :

/vol/DATABASE_MECA/RESTRICTED_ACCESS/DATABASE_BACKFACINGSTEPFLOW_RE6000_DNS

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

Directories & files

```
/GRID : contains all ASCII 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               : ASCII files
input data file for sunfluidh : input3d.dat
data file for MPI subdomain distribution (MPI graphical topology):
data_mpi_subdomain_layout.dat
/TIMESERIES : contains time series recorded over the time range
[200,513.3]
                ASCII files : x_ins_yyyyy.d   with x= u,v,w,p
                time series files are sliced in directories CAS-MPI160-n (n
from 121 to 330)
                WARNING : possible underlying of time series for these data
couples :
                        n = (243,244)
                        n = (246,247)
                        n = (259,260)
                        n = (260-261)
                        The directory CAS-MPI160-260 contains 2 groups of
consecutive timeseries files placed in
directories DIR-A and DIR-B
/SNAPSHOTS : snapshots binary files res_xxxxx_yyyyyyy.d
            files stored in archive files : res_yyyyyyy.tar for each
time ID
/STATISTICS : statistics binary files files rst_xxxxx_yyyyyyy.d
            files stored in archive files : rst_z.tar , z is an ID
number
/RESTART_AR : backup/restart archive save.tar at 513.27 time units
```

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