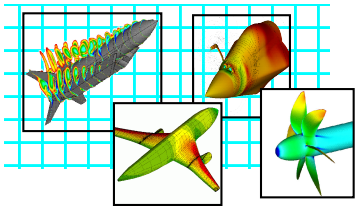
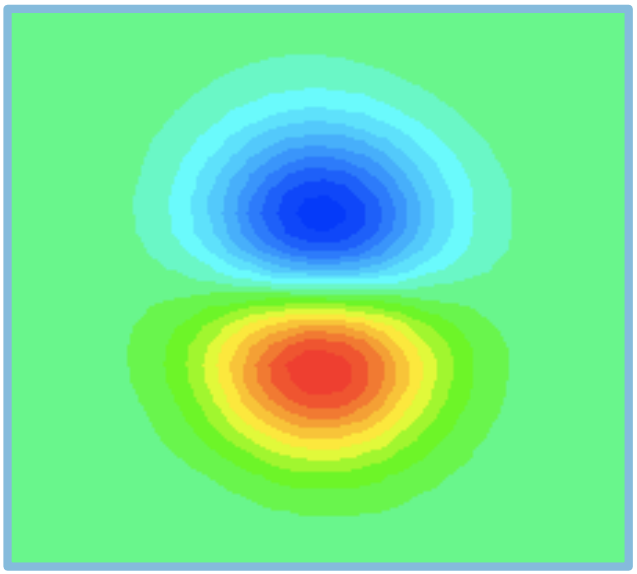


BENCHMARK ON THE VORTEX PRESERVATION



Contact :

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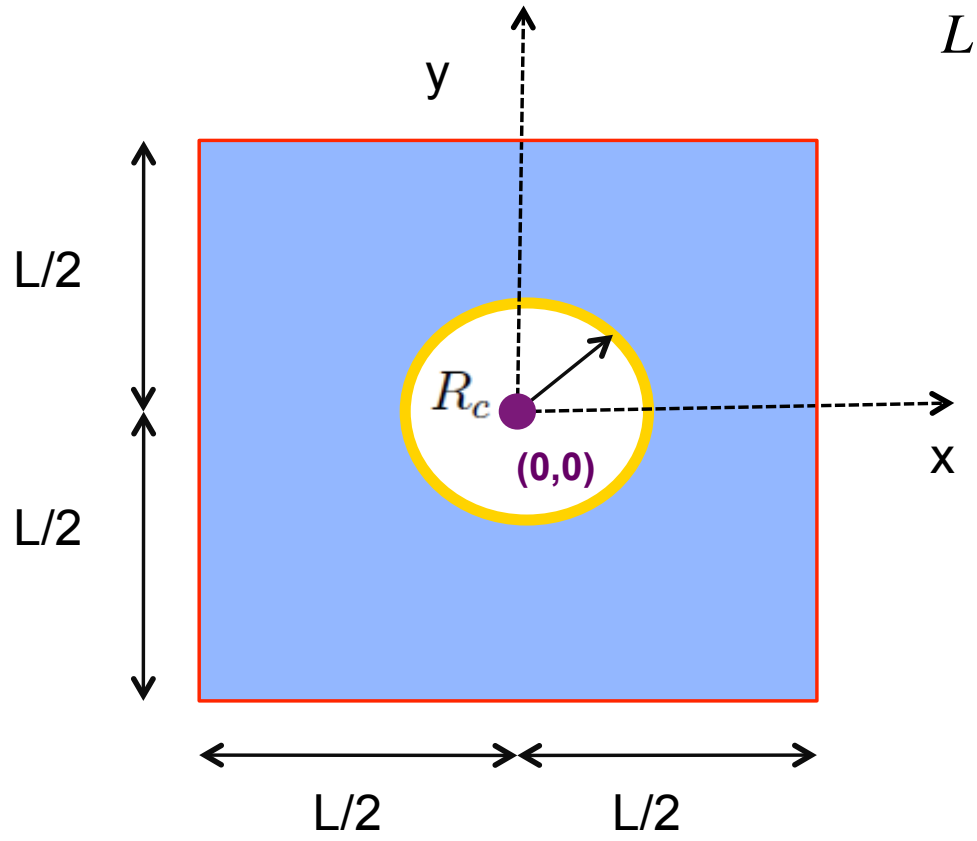
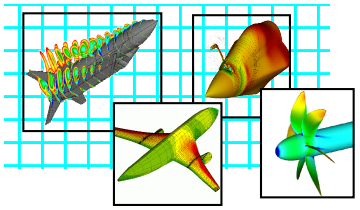
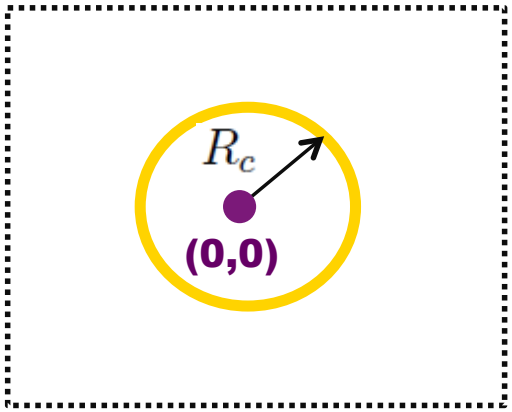
- **Geometry**

$L = 0.3112 \quad m$





- **Initial solution**



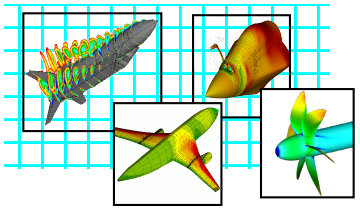
$$u = U_0 + \frac{\partial \Psi}{\partial y} \qquad v = -\frac{\partial \Psi}{\partial x}$$

$$p - p_0 = -\frac{\rho \Gamma^2}{2R_c^2} e^{-\frac{(x-x_c)^2+(y-y_c)^2}{R_c^2}}$$

$$\rho_0$$

$$\Psi(x,y) = \Gamma e^{-\frac{(x-x_c)^2+(y-y_c)^2}{2R_c^2}}$$

Truncate the exponential after 4 radius !



- **Flow field definition**

$$\rho_0 = 1.17170407 \quad kg.m^{-3}$$

$$T_0 = 300 \quad K$$

$$P_0 = 101300 \quad Pa$$

$$U_0 = 35 \quad m.s^{-1}$$

$$\Rightarrow \quad Mach = 0.1$$

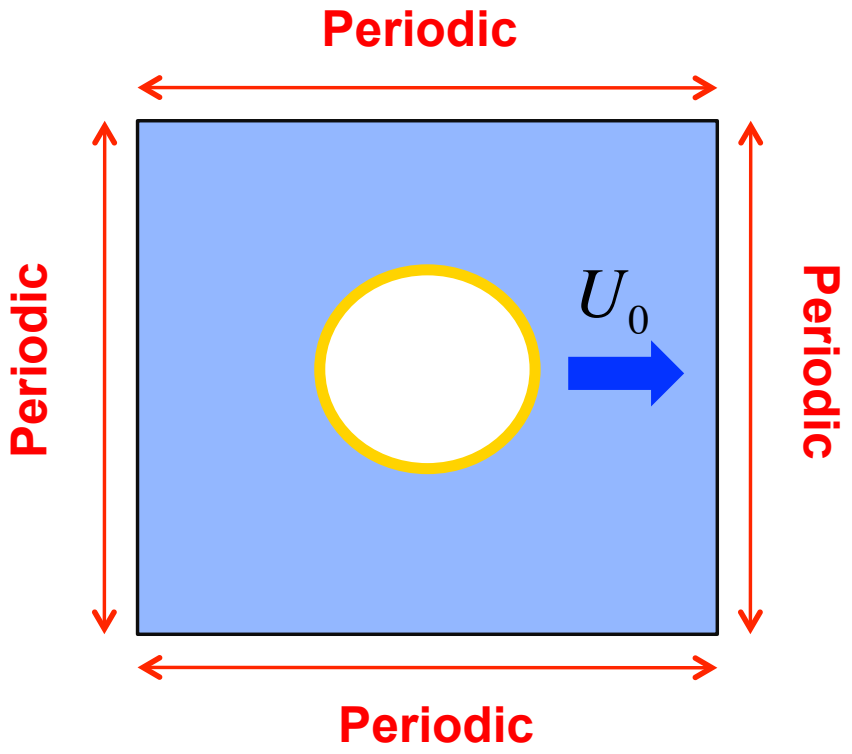
- **Vortex caracteristics**

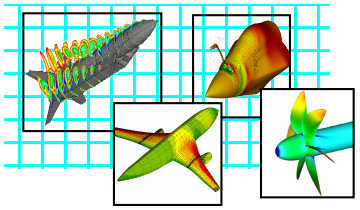
$$U_{\max} = 4\% \quad U_0 = 1.4 \quad m.s^{-1}$$

$$\Gamma = U_{\max} \quad R_c \quad \sqrt{e} = 3.59157 \quad 10^{-2}$$

$$R_c = L/20 = 0.01556 \quad m$$

- **Boundary conditions**





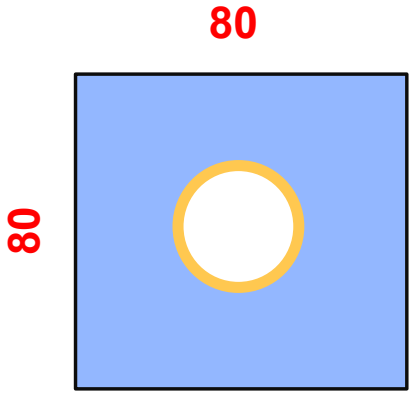
- **Two cartesian meshes**

2D, 1 run

Analysis of precision

Serial: 6400 cells

$Mach = 0.1$



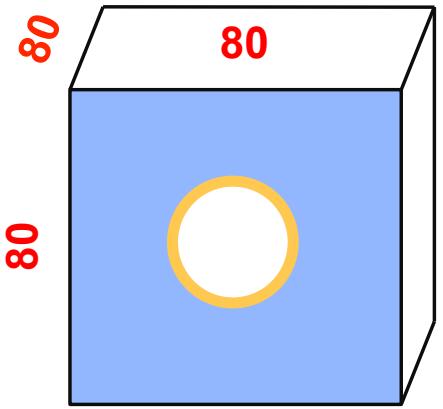
3D

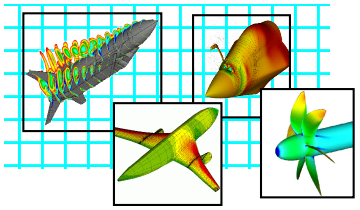
4 runs

Analysis of performances

Parallel: 512000 cellules

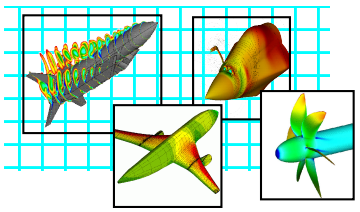
$Mach = 0.01,\ 0.1,\ 0.2,\ 0.3$





- **Rules to follow**

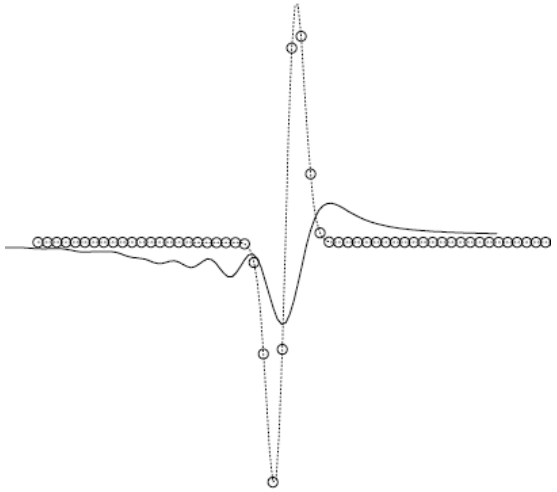
  - **Use your best temporal/spatial scheme**
  - **Use an explicit scheme with CFL = 0.7**
  - **Do not adimension the flow data, use the real values**
  - **Format of the results : Tecplot ASCII**



- **Elements of comparison**

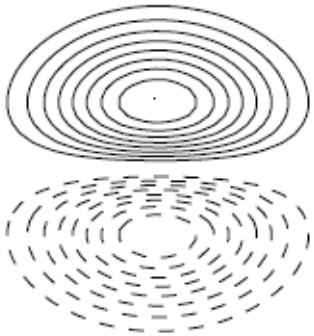
Profiles of v at y=0 :

$$t_1 = 10\frac{L}{U_o} \quad t_2 = 20\frac{L}{U_o} \quad t_3 = 30\frac{L}{U_o} \quad t_4 = 40\frac{L}{U_o}$$

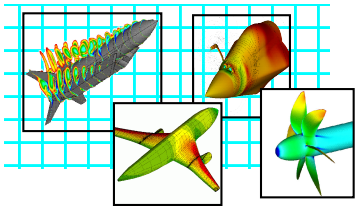


Contours of $u - U_0$:

$$t_1 = 10\frac{L}{U_o} \quad t_2 = 20\frac{L}{U_o} \quad t_3 = 30\frac{L}{U_o} \quad t_4 = 40\frac{L}{U_o}$$



Performances : speedup and reduced efficiency



- **Summary of simulations to perform**

RUN	Name	Mach	Size	Output	Quantities	Format
1	vortex2D_0.1_80	0.1	80 x 80	t_1, t_2, t_3, t_4	v $u - U_0$	Tecplot ASCII
2	vortex3D_0.01_80	0.01	80 x 80 x 80	X	X	X
3	vortex3D_0.1_80	0.1	80 x 80 x 80	X	X	X
4	vortex3D_0.2_80	0.2	80 x 80 x 80	X	X	X
5	vortex3D_0.3_80	0.3	80 x 80 x 80	X	X	X