**²Tutorial series 01**

**Exercise 01**

The velocity field of a two-dimensional flow is defined by:

$$\vec{V} = y\,\vec{\imath} - x\,\vec{\jmath}$$

Determine the equation of the streamline passing through the point $(1, 0)$.

**Exercise 02 (home work)**

The velocity field of a steady, incompressible, planar flow in the $X$–$Y$ plane is given by:

$$\vec{V} = a\,x\,\vec{\imath} - b\,y\,\vec{\jmath} \text{ with } a = b = 1\ [s^{-1}]$$

1. Find the equation of the streamlines of the flow.

**Exercise 03**

The velocity field of a steady, incompressible flow is given by:

$$\vec{V} = Axy\,\vec{\imath} + By^2\,\vec{\jmath}$$

Given: $A = 1\ [1/m.s]$ and $B = -0.5\ [1/m.s]$

1. Check if this flow is conservative.
2. Determine the equation of the streamlines of this flow.
3. What is the type of the flow? Why?

**Exercise 04**

We consider the flow defined in Eulerian variables by:

$$\begin{cases} u = \omega x \\ v = \omega y \\ w = -\omega x + \alpha t \end{cases}$$ where $\omega$ is not zero.

1. Is this flow stationary (steady), incompressible?

**Exercise 05**

The velocity field of a flow is given by:

$$\vec{V} = ax^2\vec{\imath} + bxy\vec{\jmath} \text{ with } \ a = 2\ [1/m.s];\ b = -4\ [1/m.s].$$

1. Is this flow steady (permanent)?
2. *Determine the equation of the streamlines of this flow.*

**Exercise 06**

*We consider the flow defined in Lagrangian variables by:*

$$\begin{cases} x = a + \alpha t \\ y = b + \beta t^2 \\ z = c + \gamma t^3 + c\alpha t \end{cases}$$

*Give the velocity $\vec{V}$ of this flow in Eulerian variables*