



# MAIDESC M36

Alexandre Boilley – Romain Klein  
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# 1. Simulations

“

*Transvalor has to simulate a free rotating wind turbine in realistic wind conditions.*

”

# 4 Automatic meshing process

In the previous meeting (M30) TSV presented the basis of the automatic meshing process developed during the MAIDESC project.

## **PREVIOUSLY**

- Working on immersed method.
- Test of filtering methods.
- Test of filtering parameters.
- Setup automatic parameters depending on the mesh elements size.

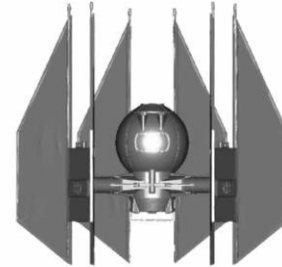
## **NOW**

- The method has been tested on several cases.
- The mesh number of elements is increasing at each remeshing iteration.
- Depending on the geometry complexity and the initial number of elements, a satisfying mesh is generated in several hours.

## Submarine



## TIE Defender



More videos available on Aeromines YouTube channel:

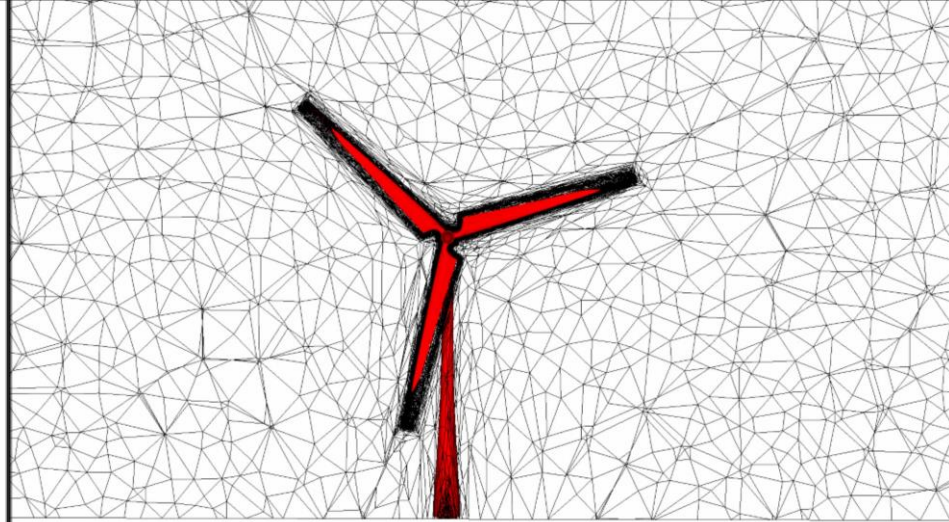
<https://www.youtube.com/channel/UCPSnEhkEkXKXbGtnz84js9A>

# Wind turbine

Initial meshing



Rotating wind mill



More videos available on Aeromines YouTube channel:

<https://www.youtube.com/channel/UCPSnEhEkXKXbGtnz84js9A>

# Challenges

- ▶ Edge Based Metric has been designed for a single criterion

Metric

$$M^i = \left( \frac{1}{d} \sum_{j \in \Gamma(i)} s_{ij}^2 \mathbf{X}^{ij} \otimes \mathbf{X}^{ij} \right)$$

Stretching Factor

$$s_{ij} = \left( \frac{\lambda}{e_{ij}} \right)^{\frac{1}{p+2}}$$

$$\lambda = \left( \frac{\sum_i \sum_{j \in \Gamma(i)} e_{ij}^{\frac{p}{p+2}}}{A} \right)^{\frac{p+2}{p}}$$

Error

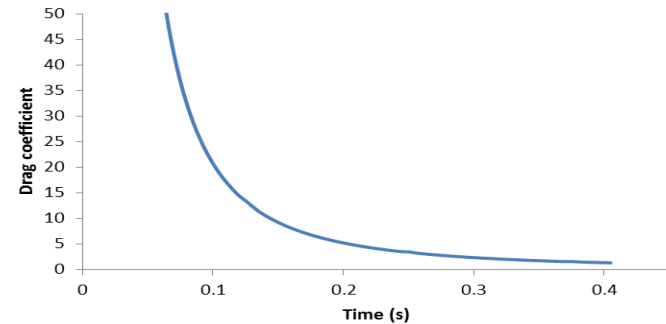
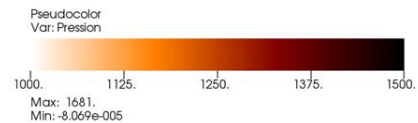
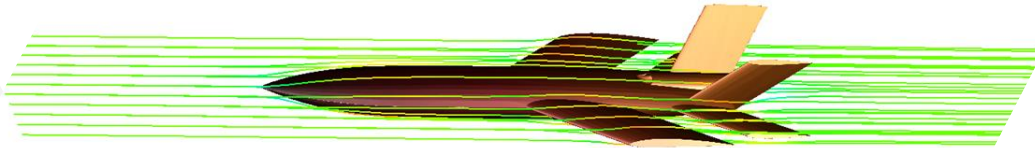
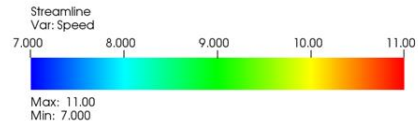
$$e_{ij} = \mathbf{g}^{ij} \cdot \mathbf{X}^{ij}$$

# Challenges

- ▶ Gradient is computed for each component
  - ▶ Error is obtained using a  $L_2$  norm of the complete set
  - ▶ When gradients are highly different only the maximal value is maintained
  - ▶ This lead to the lost of information, mainly the levelset for high Reynolds.



# At low Reynolds



2.

# Aeromines Platform

“

*Aeromines doit faire la promotion, valoriser et diffuser les travaux de recherche.*

”

# M12 – Aeromines POC

The screenshot shows the Aeromines dashboard interface. At the top left, the user profile for R. Klein is visible. Below the profile, there are sections for 'Applications' and 'Results'. The main area displays a grid of simulation applications, each with an icon and a title:

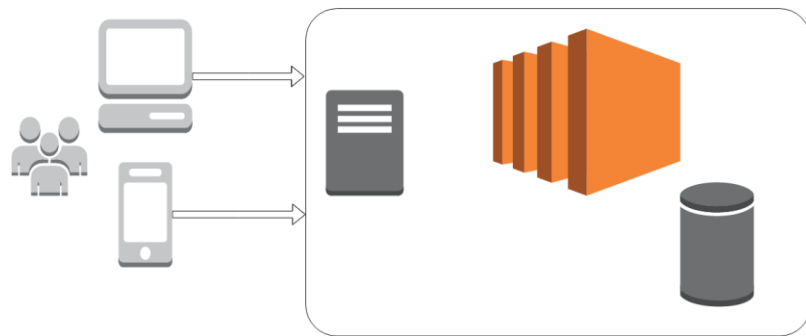
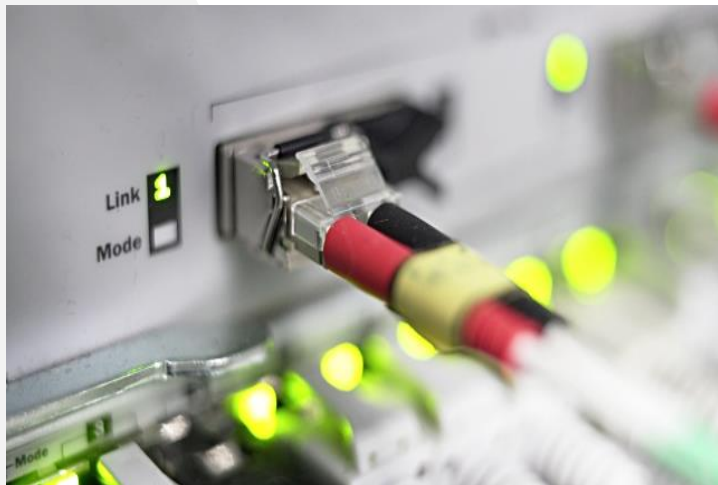
- Driven Cavity #CFD #3D
- Boundary Layers #CFD #Refining
- NACA0012 airfoil #CFD #3D
- RAE2822 airfoil #CFD #3D
- ONERA M6 Wing #CFD #3D
- Flow around a circular cylinder #CFD #3D
- Flow across a square cylinder #CFD #3D
- Bingham flow #CFD #3D
- Flow past a F1 car #CFD #3D

On the left side, an 'ACTIVITY' log shows a sequence of 'Flow Cylinder' starting and stopping events. At the bottom, the footer reads '2014 © Aeromines S.1' and 'Crafted with ❤️ by T3WebUI'.

This screenshot shows the control panel for a simulation. On the left, an 'ACTIVITY' log shows the simulation starting and stopping. The main area is divided into three sections:

- Speed magnitude:** A 2D heatmap showing the velocity magnitude of the flow around a cylinder. The color scale ranges from blue (low velocity) to red (high velocity).
- Streamlines:** A 2D plot showing the flow streamlines around the cylinder, with red lines indicating the flow path.
- Controls:** A panel with a 'Running' button (blue) and a 'Stop simulation' button (red).
- Parameters:** A list of simulation parameters with input fields:
  - Time Step: 0.1
  - Storage Frequency: 10
  - Number of Elements: 10000
  - Minimum Mesh Size: 0.0001
  - Mesh Adaptation Frequency: 10
  - Reynolds Number: 1000An 'Update Parameters' button is located below the list.
- Status:** A section showing the 'Job ID' as 18336.

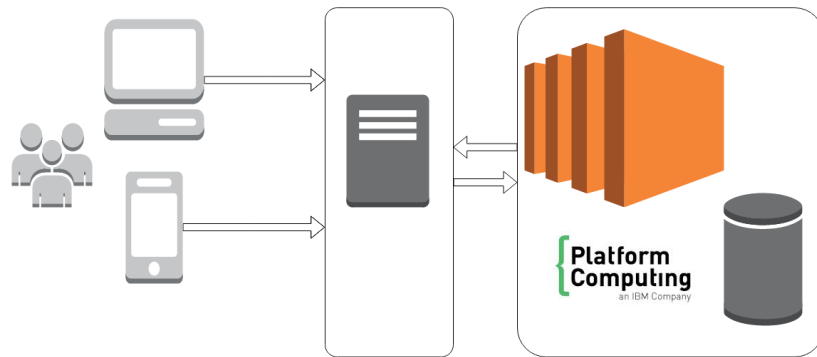
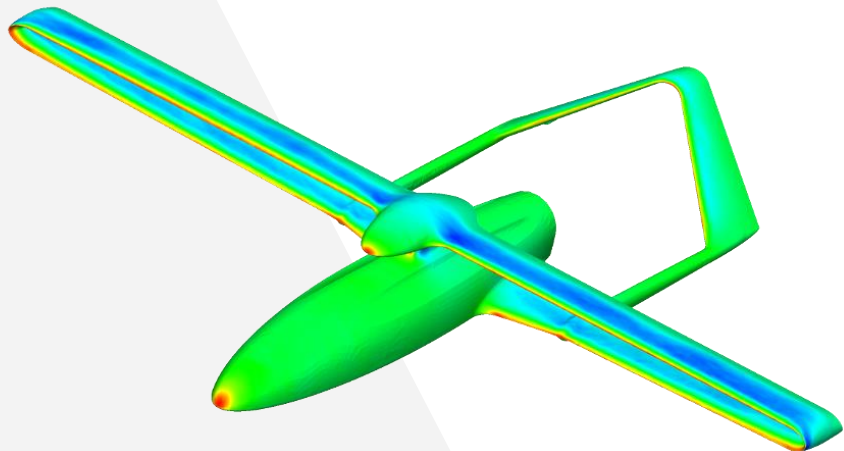
# Aeromines – Calcul Haute Performance Délocalisé



## AVANTAGES

- ▶ Facilité d'utilisation (Interface personnalisée, Gestion de compte, ..)
- ▶ Répertoire d'applications
- ▶ Visualisation distante temps réel

# Aeromines vers le nuage



## AVANTAGES

- ▶ Environnement de Production
- ▶ Sécurité des données (encryption, IPsec, ..)
- ▶ Cloisonnement par Utilisateur
- ▶ Elasticité des ressources

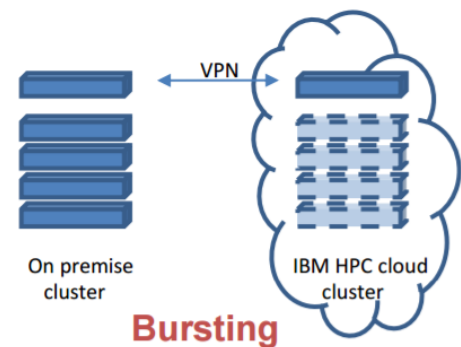
# 10

Le vrai coût du nuage pour le  
Calcul Haute Performance?

Vers une solution  
hybride!



# Aeromines – « Cloud Hybride »



## AVANTAGES

- ▶ Ressources illimitées
- ▶ Meilleure gestion des ressources
- ▶ Orchestration globale
- ▶ Local?