Caradonna-Tung

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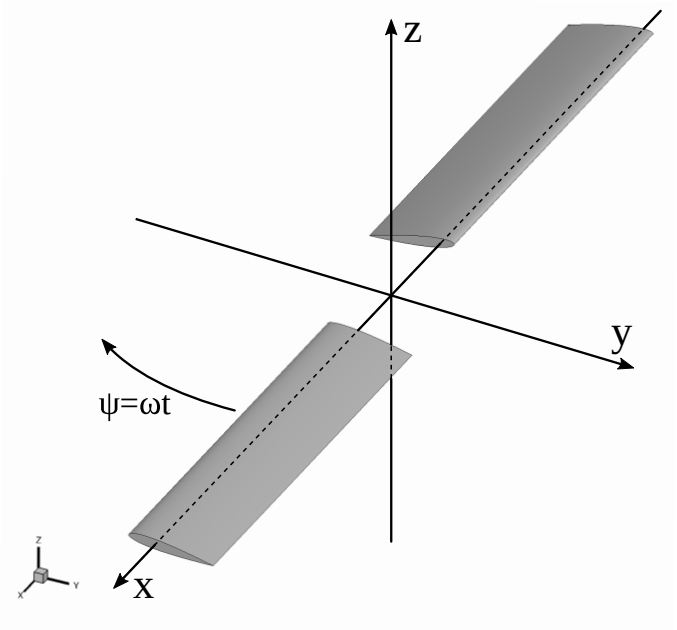
Model presentation



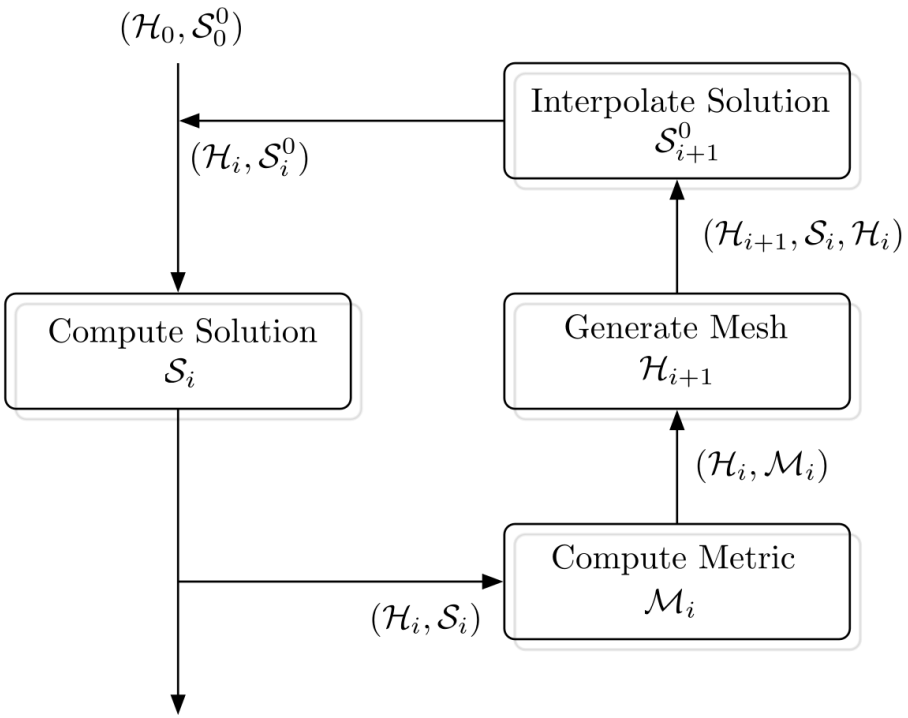
Three computations :

- RANS-SA (3.5M vertices, NOISEtte)
- DES (150M vertices, NOISEtte)
- RANS-SA adapted mesh (2.2M vertices, NiceFlow)

(*)F. X. Caradonna, C. Tung, Technical Report NASA-TM-81232, 1981.

MRF method and mesh adaptation

- Mesh adaptation



$\mathcal{H}$, $\mathcal{S}$ and $\mathcal{M}$ are respectively the mesh, the solution and the metric.

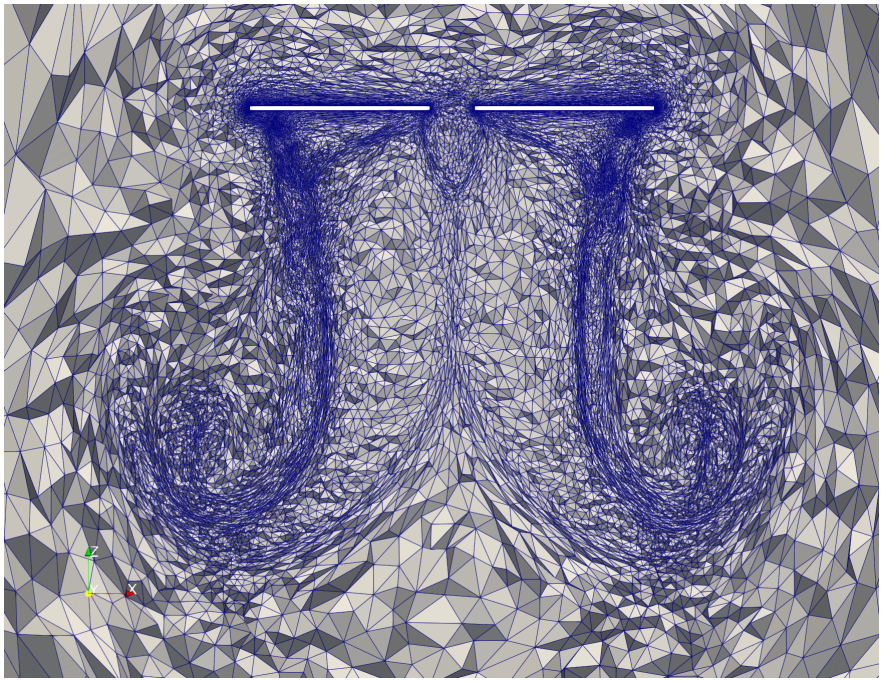
- Multiple Reference Frame (MRF)
  - Considering the velocity compositions :

$$\mathbf{u} = \mathbf{u}' + \boldsymbol{\omega} \times \boldsymbol{x}$$

we rewrite the Navier-Stokes equations in absolute velocity formulation.

  - The computational domain is divided into two sub-domains. A cylindrical box around the helix where $|\boldsymbol{\omega}| = 650$ rpm, and an another cylindrical sub-domain around the box containing the helix where $|\boldsymbol{\omega}| = 0$.

Numerical results



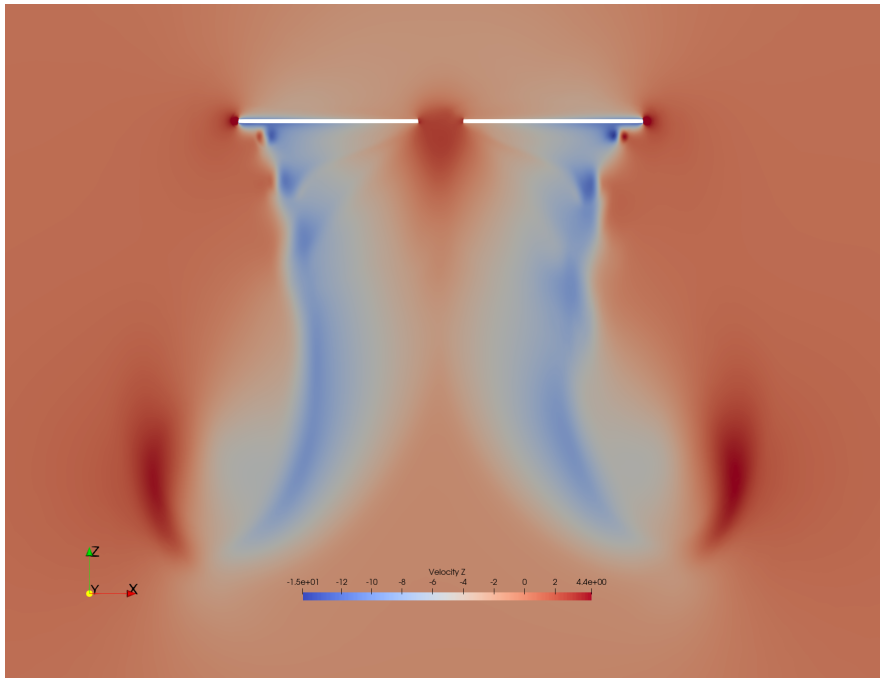


Figure – Caradonna-Tung RANS simulation results : mesh (left) and velocity field (right) in cross-section.

Numerical results

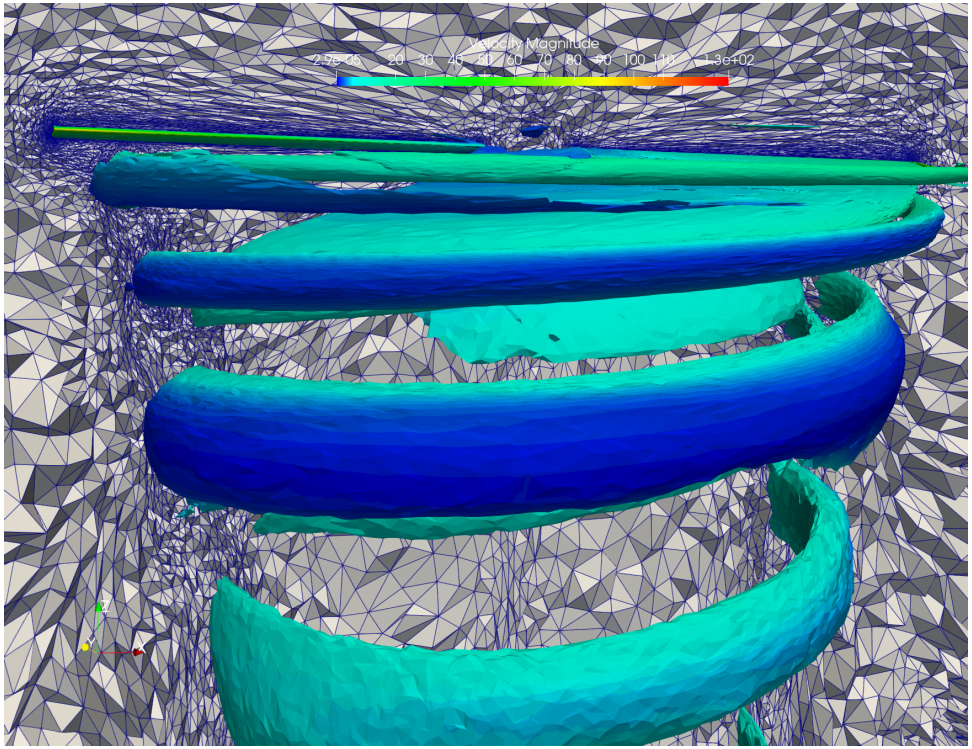


Figure – Caradonna-Tung
RANS simulation results :
Q-criterion iso-surface with mesh.

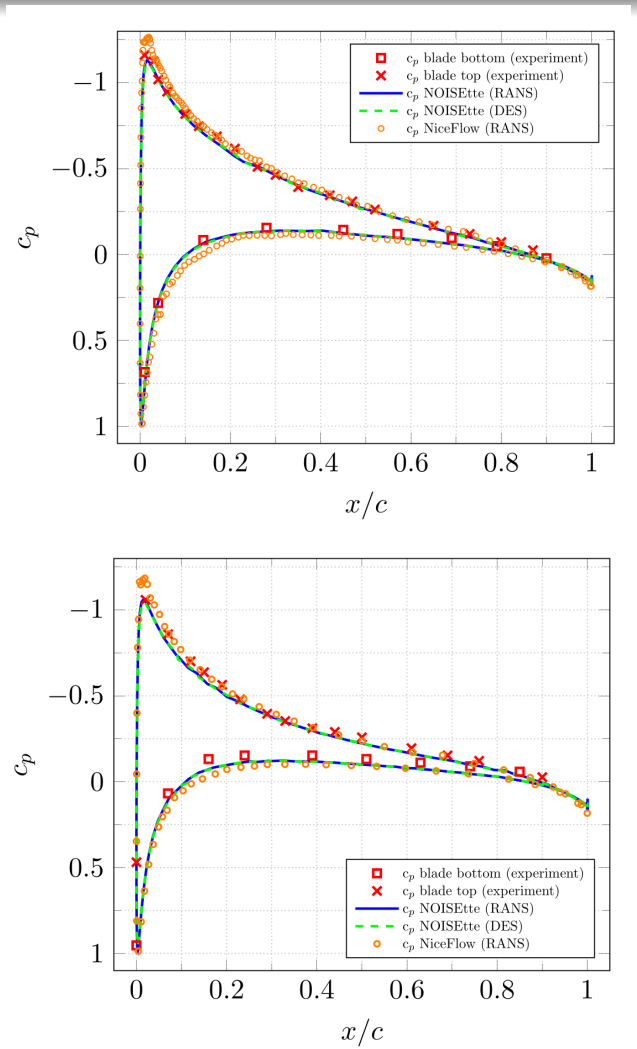


Figure – Pressure coefficient at $r/R = 0.89$ (left) and $r/R = 0.96$ (right) blade sections.