Ph.D Student presentation

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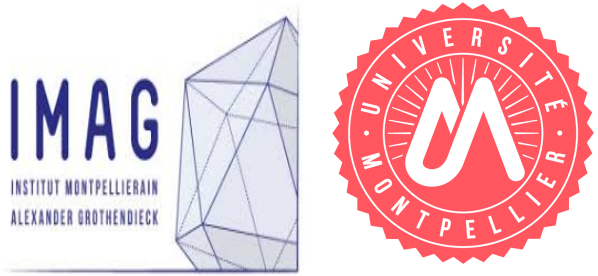


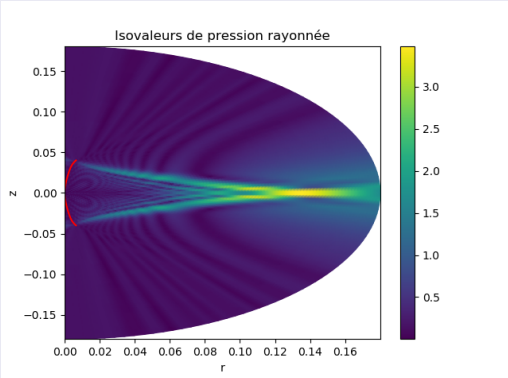
Presentation

General

- *25 years old*
- *Studied at Montpellier University*
- *Graduate of M2 Modelisation and Numerical Analysis*

Stage

- *M2 project : I worked at the C.E.A, on ultrasonic ray for determine an optimal acoustic lens geometry*



Master

- *Error a posteriori estimation of numericals schemes*
- *Numerical Analysis of Hybrid High Order method*
- *Optimal control*
- *Advanced programmation for mathematicians*
- *Numerical modelisation of the compressible Navier-Stokes équation by finite-Volume methods*

Thesis goal

Context

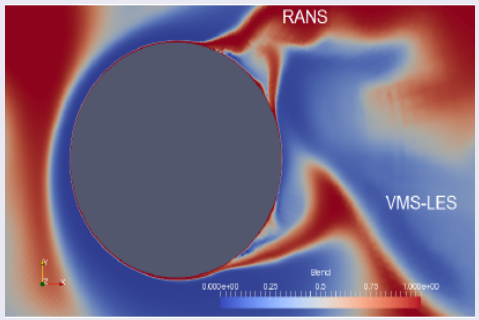
- *Ecology of urban/extra-urban areas increasingly deteriorated by noise emission generated by rotating machines (helicopters, drone delivery, winds turbines ...)*


Goal

- *Make efficient prediction of noise by aerodynamics and aeroacoustics simulations of rotating machines*

How ?

- *Combination of :*
  Hybrid turbulence model (RANS/VMS-LES) $\oplus$ Immersed boundary method and/or chimera method



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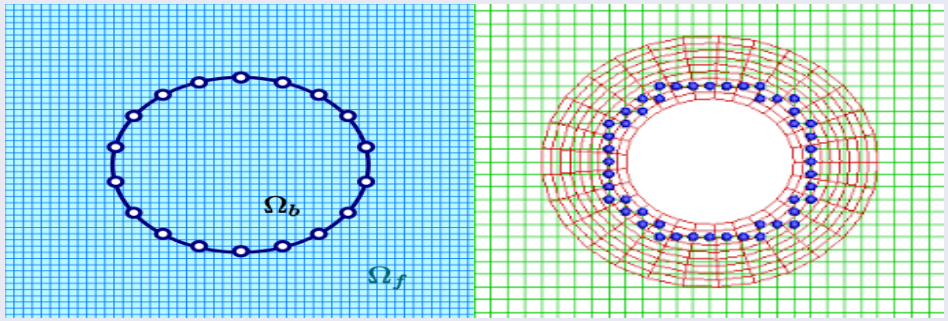

- *Adaptation of these methods to aeroacoustics*
- *Development of* AIRONUM *parallel code*

- RANS/VMS-LES

  $< W >$: variables related to RANS approach

  W^c : fluctuation resolved

  W' : small scale variables resolved

$$(\frac{\partial W}{\partial t}, \chi_i) + (\nabla \cdot \mathcal{F}_c(W), \chi_i) + (\nabla \cdot \mathcal{F}_v(W), \phi_i) =$$

$$-\theta(\tau^{RANS}(< W >), \phi_i) - (1-\theta)(\tau^{LES}(W'), \phi_i')$$

$\mathcal{F}_c$: convectif flux treat by finite volume

$\mathcal{F}_v$: viscous flux treat by finite element

$\tau^{LES}(W')$: closing LES term

$\tau^{RANS}(< W >)$: closing RANS term

θ : RANS/VMS-LES hybridation function in $[0, 1]$

Planning

A priori planning

- 1^{st} *year :*
  - *Bibliography (numericals models used, chimera method, immersed boundary method)*
  - *Getting started with the AIRONUM code*
  - *Adaptation of hybrid turbulence model for aeroacoustics*
- 2^{nd} *year :*
  - *Multirate time advancement method*
  - *Implementation of the immersed boundary method*
  - *Flow simulations arround a helicopter rotor*
- 3^{rd} *year :*
  - *Finalization of flow simulations*
  - *Thesis redaction*