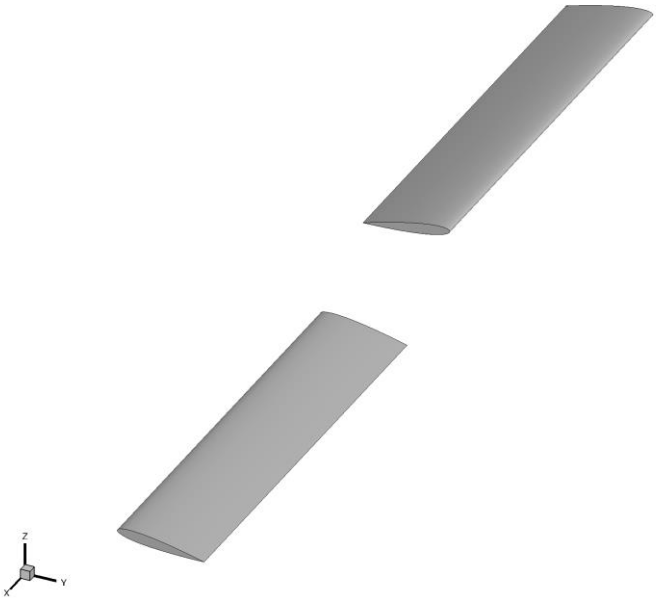
Caradonna-Tung rotor*

NOise of **R**otating **Ma**chines (**NORMA**)

WP1 Evaluation of hybrid RANS-LES methods of scale-resolving simulation of turbulent flows developed by partners, their further development and adaptation to the problems of turbulent flow past rotating rotor blades of helicopters.

*Caradonna F. X., Tung C. Experimental and analytical studies of a model helicopter rotor in hover: tech. rep. ; NASA. — Ames Research Center, Moffett Field, California, Sept. 1981. — NASA-TM-81232.

Case description

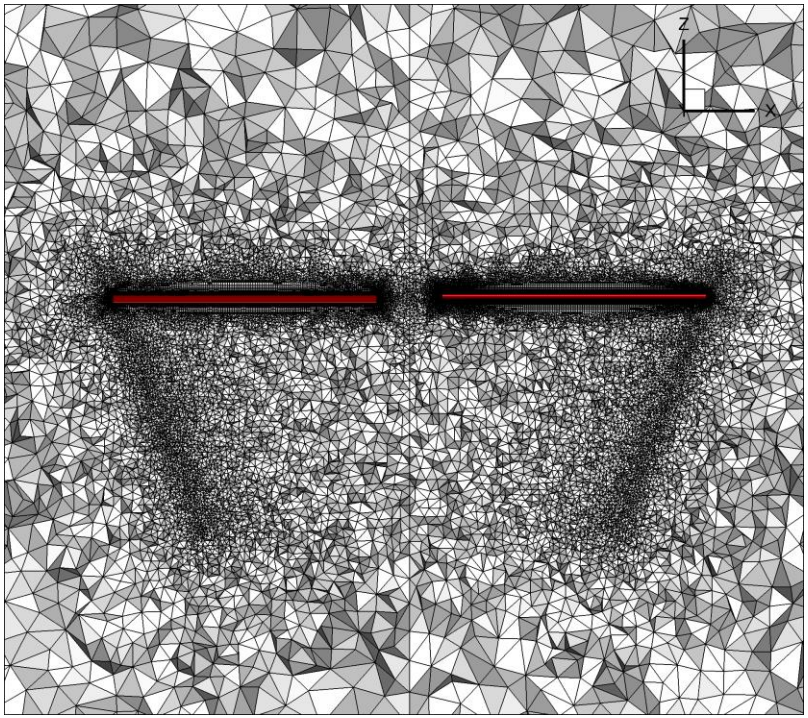


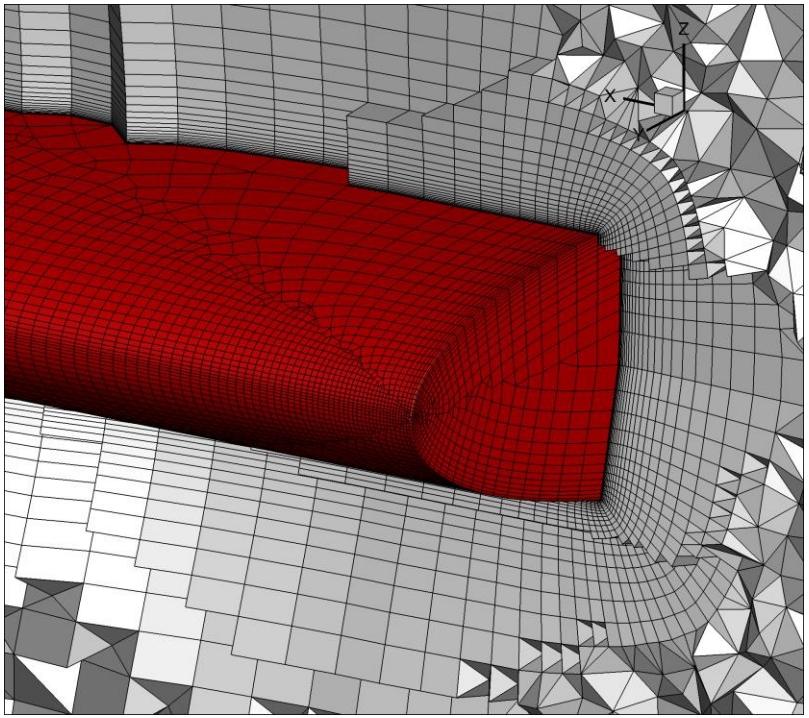
N – blades number	**2**
R – rotor radius	**1.143 m**
b – blade chord length	**0.1905 m**
blade base airfoil	**NACA-0012**
pitch angle	**8º**
rotation speed	**650 RPM**
blade tip velocity V_{tip}	**77.8 m/s**
tip Mach	**0.228**

$$\rho_0 = 1.2041\ \mathrm{kg/m^3}, \mu_0 = 1.827 \times 10^{-5}\mathrm{N \cdot s/m^2}$$

$$\mathrm{Re} = \frac{\rho_0 V_{tip} b}{\mu_0} = 0.97 \times 10^6$$

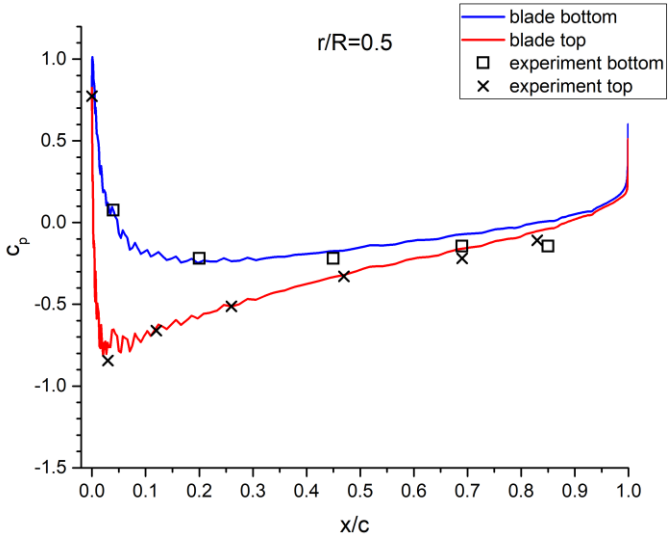
RANS case: mesh

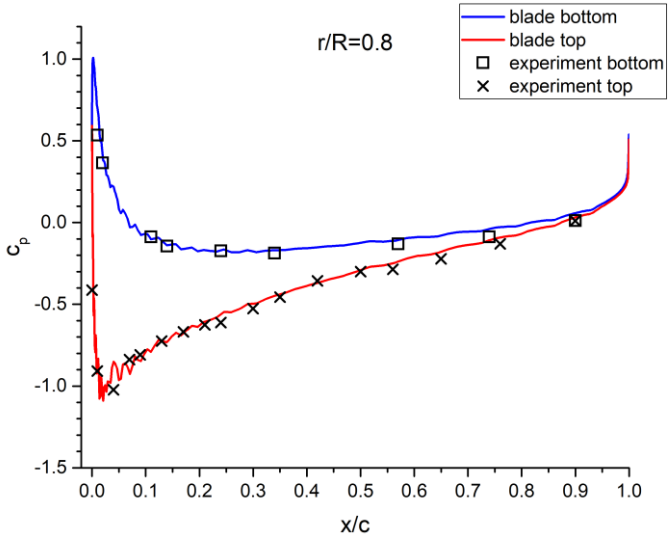


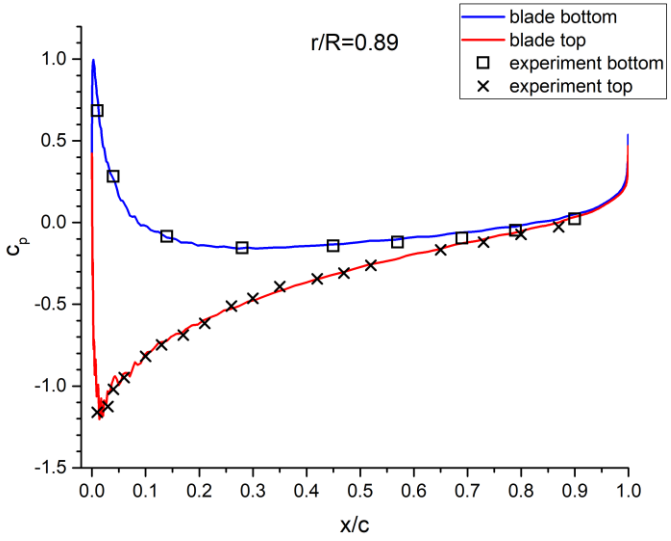


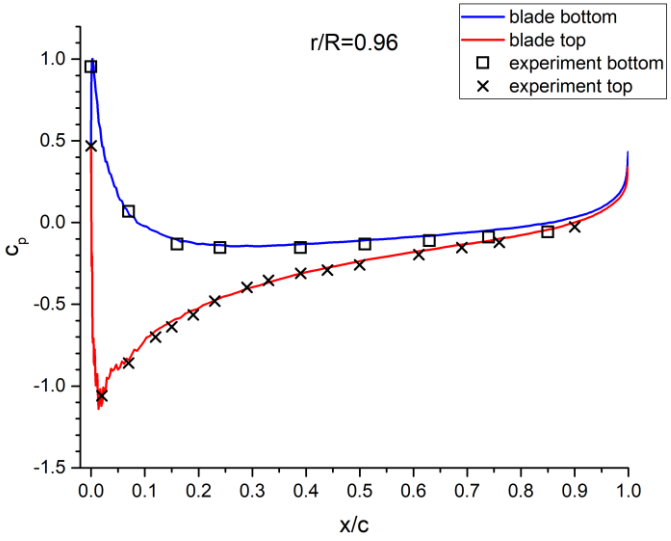
3.5M nodes, 13.7 elements

RANS case: aerodynamics

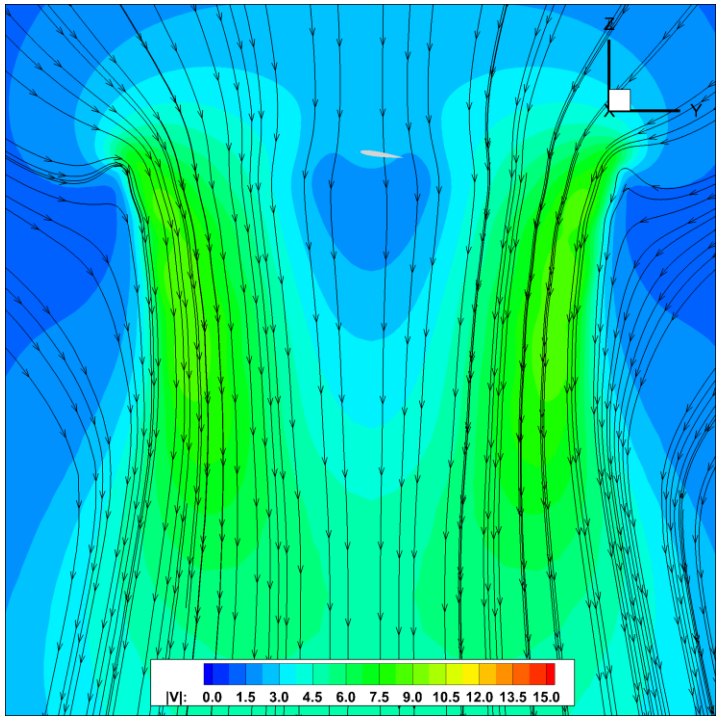


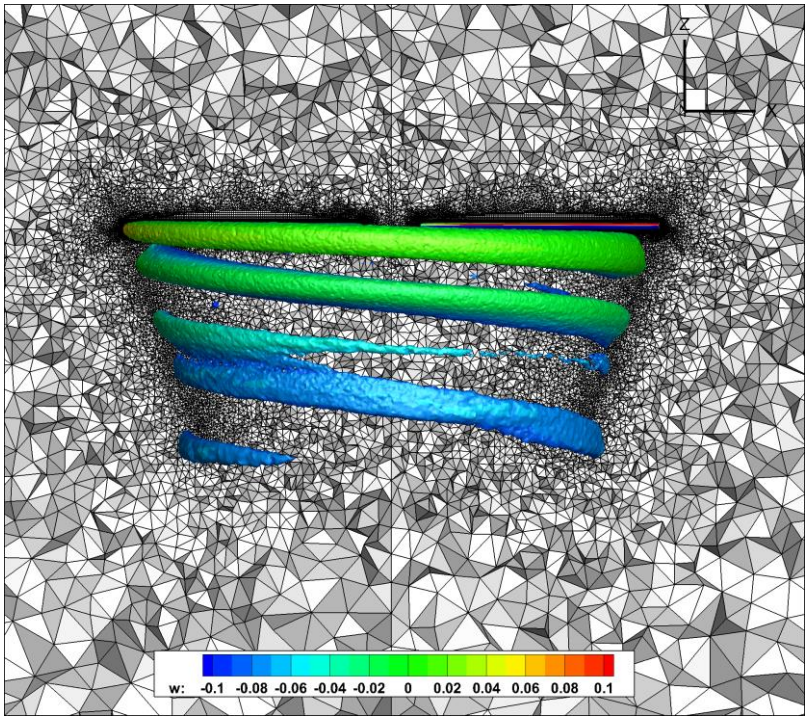




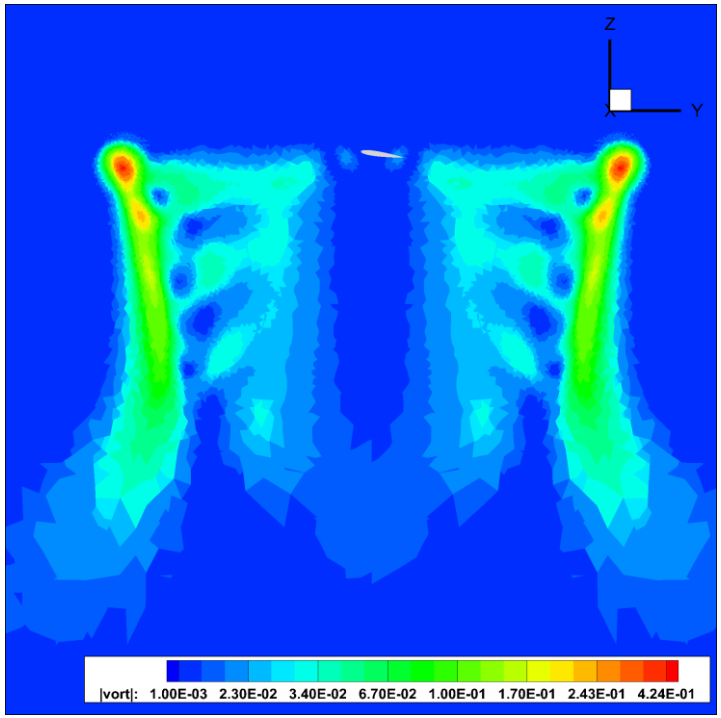


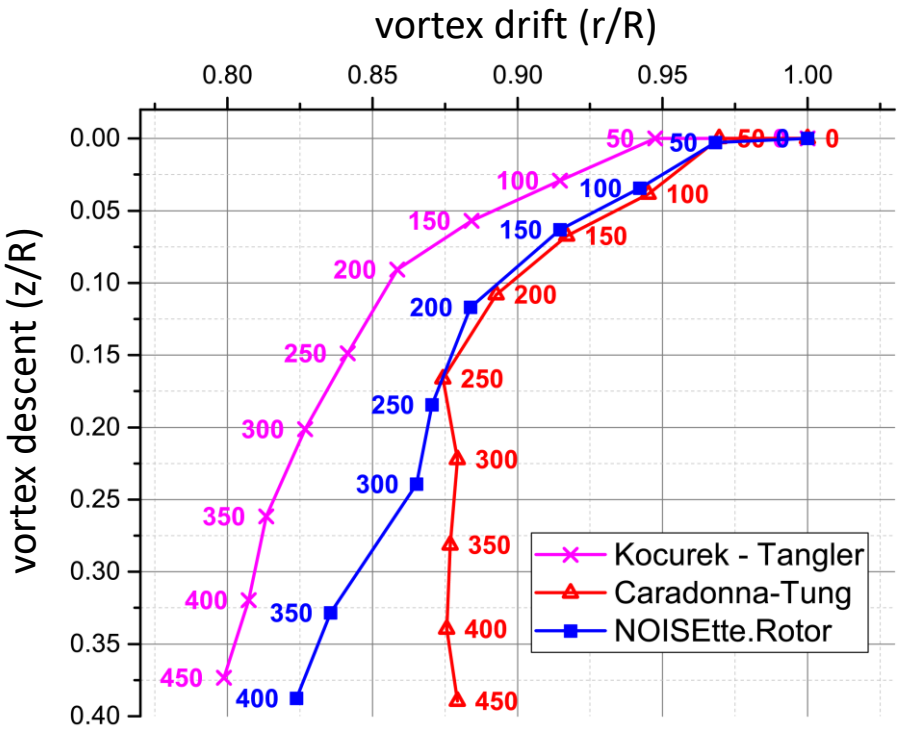
RANS case: flow & tip vortex





RANS case: flow & tip vortex





Summary

What we have?

- experimental case setup
- experimental data (aerodynamics)
- rotor geometry (CAD: IGES)
- RANS case mesh (CGNS)
- RANS numerical results
- Preliminary DES case mesh (refined near rotor blades)

To do

- Preliminary DES calculations
- Refined DES mesh(es)
- Final DES case calculation