Enric ROCA LEON Doctorant à l'Onera soutiendra ses travaux de thèse :

"Simulations aéromécaniques pour l'optimisation de rotors d'hélicoptère en vol d'avancement "

le Mardi 14 Octobre 2014 à 14h00 à l'Onera Meudon

devant le jury composé de :

RAPPORTEURS

Paola CINNELLA	**Professeur Arts et Métiers Paris Tech**
Philippe DEVINANT	**Professeur Institut Prisme Orléans**

EXAMINATEURS

David ALFANO	**Ingénieur Airbus Helicopters**
Serge HUBERSON	**Professeur LEA Université Poitiers**
Arnaud LE PAPE	**Ingénieur de Recherche Onera**
Michel COSTES	**Maître de Recherche Onera**

DIRECTEUR DE THESE

Jean-antoine DESIDERI	**Directeur de Recherche Inria**

RESUME

This work addresses the development of a multi-objective optimization framework for helicopter rotor blades using high-fidelity simulation models. In particular, objective functions corresponding to hover and forward flight are considered. Two solvers are used to predict the rotor performance: the comprehensive rotor code HOST and the Computational Fluid Dynamics (CFD) solver elsA. The first research axis of this work is the characterization of the accuracy of each available prediction method.
The influence of considering the blade elasticity, the rotor trim and/or simplified aerodynamics is characterized for each flight case using wind-tunnel data. As a result, a numerical framework adapted to the optimization is developed. The second part of this work concerns the formulation and development of techniques adapted to the multi-objective optimization of rotor blades in hover and in forward flight. Innovative algorithms based on competition (Nash Games) and cooperation
(Multi-Gradient Descent) are presented as alternatives to traditional multi-objective approaches.
In order to reduce the simulation costs, a surrogate-based framework is developed, including a multi-fidelity strategy to predict the rotor performance in forward flight. These techniques are finally applied to a realistic rotor, considering trimmed elastic CFD computations in the forward flight case and rigid blade CFD computations in the hover case. The results are subsequently analyzed, demonstrating the potential of these techniques to obtain realistic designs realizing interesting
trade-offs.

Mots clés : OPTIMIZATION, NASH, HELICOPTER, ROTOR, AERODYNAMICS