

Projet TransForMD

Influence de la Transition de l'écoulement sur la performance aérodynamique des Micro-Drones

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Ecole doctorale: MEGEP

Equipe d'accueil doctoral: EDYF: DAEP (18 mois) et ONERA /DMPE (18 mois)

Cofinancements envisagés: ONERA

Cofinancement ISAE demandé (si oui argumentaire): Oui

Thèses actuellement encadrées: T. Désert (soutenance janvier 2019), Y. Leng (2017-2020), V. Drouet (2016-2019), R. Perret (2016-2019)

Candidat.e: TBD

Domaine scientifique: Aérodynamique

Mots-clés: transition, bas nombres de Reynolds, taux de turbulence, rotor, micro-drones

Résumé:

Unmanned Aerial Vehicles have encouraged us to rethink the way conventional aerodynamic design is conducted. The low speed, size of aerodynamics surfaces, lifting or propulsive, and altitude of operation reduces significantly the Reynolds number (Re) regime at which they operate. On the other hand, Micro Air Vehicles (MAVs) are subject to high turbulence intensity levels due to perturbed atmospheric conditions in the urban environment. In this low Re (10^3 - 10^5) and high turbulence intensity regime, the behaviour of the flow over the aerodynamic surface is more complex to predict although it has been hardly addressed by the scientific community so far. In a laminar state, the flow is more prone to separate causing considerable deterioration in performance, stability of the overall vehicle or in worst case scenarios with more severe consequences such as massive stall or control loss. In a turbulent state the boundary layer (BL) is more resilient to separation, therefore it is important to predict when the flow will transition. This doctoral campaign aims at assessing the transition prediction capability as applied to MAVs, including fixed-wing and rotary-wing aerodynamics subjected to the surface curvature and roughness, the turbulence characteristic of the ambient region of operation and background noise. Wind tunnel campaigns will be conducted with varying turbulence intensities and numerical methods will be assessed based on the experimental findings.