# PhD proposal ISAE-SUPAERO/ENAC

## Energy harvesting using an UAV with flexible wings: development of robust control laws

**Summary**: The objective of the thesis is to study the extraction of aerological energy on flexible fixed-wing mini-drone . For low-speed fixed-wing mini-drones operating at low altitude and at low speeds, flying through atmospheric disturbances represents a significant source of energy for increasing the endurance (see V. Bonnin 2015; Gavrilovic 2018). This effect is exploited in nature by a number of birds. So far, the work has been focused on rigid drones. The idea of the thesis is to introduce some flexibility in the wing so as to maximize the energy extracted during the flight. This requires studying aeroelastic phenomena related to a flexible drone and specific command laws taking into account the flexibility of the drone.

The PhD thesis will begin with a state-of-the art of flexible structures and their adaptation to fixed-wing mini-drones. A first theoretical model based on the fluid-structure interaction will be developed and calibrated on wind tunnel tests and flight tests. The second part will develop control laws to control the flexible drone by maximizing energy extraction. Finally, the rigid drone and the flexible drone will be compared to evaluate the interest of flexibility with regard to the maximization of the endurance by extraction of energy.

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**Salary:** 24 275€ gross
**Starting date:** October 2019-January 2020