

PhD Proposal with AIRBUS – Toulouse

**For the optimization of electrical power control laws in hybrid
Propulsion vehicles**

Context: A low-emission and sustainable aeronautical industry is one of Airbus major strategic orientations. This translates into the development of more electrical aircraft and a wider importance of electrical systems.

In the frame of hybrid propulsion more electric aircraft with an on-board electrical network, the management of electrical sources (parallelization, electrical machine reversibility from generator to motor modes, etc) is an enabler to optimise the sizing and operability of the electrical system.

Moreover, to inject electrical power into the thermal engine, it is key to manage the available power while ensuring the network stability and power quality for a safe operation of the aircraft.

This requires to ensure a synergy and a strong interaction between all controllers, through the definition of an electrical control system that will coordinate the controllers of the electrical sources, network and consumers.

In this context, a CIFRE thesis position entitled "Electrical power control laws in hybrid propulsion vehicles" has opened within Airbus Commercial Aircraft in Toulouse. You will join the "Electrical Systems" department.

Thesis description (& candidate role)/ The aim of this PhD is to define an optimal control approach that would allow a better sizing of the electrical chains and better define the functional behaviour of the propulsive and non-propulsive electrical networks. It will focus on energy and power management, taking into account voltage regulation and stability. These control laws will directly impact the performance of the electrical system but also the robustness and integration of technological bricks, in particular the power conversion stages.

In addition, the thesis results will be driven by inputs collected from the Propulsion System in order to frame the needs and benefits on the engine side.

The thesis will be carried out in collaboration with the LAPLACE laboratory.

Scientific challenges/ High level of complexity: manage the coupling between electrical sources operating in parallel vs network stability vs safety. Define control laws to manage the behaviour of both the propulsive and non-propulsive electrical networks. Ensure synergy between the electrical system control with regards to electrical bricks local controllers (short term loop vs long term loop)

Responsibilities & Deliverables/ You will be responsible for the following main activities:

- Build a state of the art on electrical control laws, control architectures/strategies Trade-off and evaluation with regards to specific criteria (System performance, stability, integration)
- Proposal of an optimised control strategy and feedback to the power architecture
- Definition, Modelling/simulation and implementation of the control laws in a limited power test bench for validation as a first step, then in an Airbus representative bench.

Required competences/ You have the following training, experience and skills:

- Holder of a Master's degree (or equivalent) in the field of Control, automation and electrical engineering or similar
- Understanding of electrical bricks local control laws (DC/DC converters, MCU, etc)
- Good knowledge of modelling and simulation tools (Matlab/Simscape are necessary, SaberRD is appreciated)
- Innovative approach,
- Rigorous, independent,
- Ability to take initiatives with a good sense of analysis,
- Communication and presentation skills
- Language skills: Advanced level in English and French

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