Saint-Louis, le 23/10/2013

INTERNSHIP PROPOSAL

Title :   **LPV modeling of a flying vehicle**

Profile :   - Master internship
- Good background in signals and systems, control systems and MATLAB/Simulink
- Knowledge in aerodynamics and flight mechanics is not necessary, but would be appreciated

Duration : Up to 6 months (possibility to continue with a PhD)

The French-German research institute of Saint-Louis (ISL) is a bi-national research organism co-funded by the Federal Republic of Germany and the French Republic. ISL employs today around 360 people, with 200 of them being attached to the scientific sector and is located in St-Louis (68), France. It possesses particular expertise on aerodynamics, flight mechanics, navigation and guidance and control for flying vehicles.

The behavior of a vehicle in flight can be characterized by a continuous-time nonlinear state-space model, constructed based on Newton/Euler laws. It is a six degrees of freedom mathematical representation, composed of twelve state variables, six global force/moment aerodynamic coefficients, and a number of measured variables and control inputs depending on its specific configuration. In order to be able to identify the model and subsequently design feedback control laws for such a system, it is proposed to consider a Linear-Parameter-Varying (LPV) modeling of a vehicle in free flight. Several global methods exist in the literature and the objective of the internship is to investigate them and choose the best suited for the construction of the LPV model. This model can be experimentally validated using free flight measurements of different architectures (re-entry space vehicles, projectiles, etc.).

The work of the internship will be focused on the investigation of various methods for the construction of the global LPV model. This model will be validated using the measured signals which include velocity measurement through a Doppler radar and embedded sensor data like 3D magnetometers and accelerometers signals. The algorithms will be executed in a MATLAB/Simulink environment.

The candidate will integrate ISL Division II (Flight Techniques for Projectiles) ABX (Aerodynamics and eXterior Ballistics) research group and will also be followed by the Division II GNC (Guidance, Navigation and Control) research group. The internship is funded by ISL, about 640€/month.

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