MULTI-STEP STRATEGY FOR ROTORCRAFT MODEL IDENTIFICATION FROM FLIGHT DATA

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Abstract: The availability of suitable methods for system identification from flight data of rotorcraft models is a key factor to enhance the competitiveness of the rotorcraft industry in the development process of new vehicles. Indeed, reliable simulation models provided by the identification techniques can be used for the design and validation of the vehicle flight control system. It allows minimizing the number of in flight experimental tests and consequently reducing costs and risks related to flight testing.

Identification methodologies generally fall into two categories: frequency-domain and time-domain. Each approach has inherent strengths and weaknesses. Much of the published works on rotorcraft identification deals primarily with frequency-domain methods, which work well at mid and high frequencies associated with the dynamics of the vehicle control inputs and the aeroelastic behaviour of the blades. On the other hand, time-domain methods, which are well assessed for the identification of fixed wing aircraft, provide accurate models at the low frequency scale that is related to the vehicle flight mechanics.

In this paper a hybrid time-frequency identification approach is described. The identification process was carried out in the framework of a multi-step strategy and a specific methodology was selected to comply with each step objective. The hybrid time-frequency approach allowed exploiting the advantage of both time and frequency methods, maximizing the information content extracted from the flight data and obtaining an identified model applicable in the whole frequency range of interest. Furthermore the multi-step strategy decomposed the complex starting problem in simplified sub-problems, which are easier to be solved.

The proposed methodology was applied to simulated data of the UH60 Black Hawk, generated using the FLIGHTLAB multi-body simulation environment. Obtained results demonstrated the effectiveness of the proposed identification strategy in terms of convergence and capability of extracting from flight data relevant information on the vehicle dynamic behaviour.

Future works will be focused on the application of the proposed methodology to set of data acquired during actual rotorcraft flight tests.