40th International SFTE Symposium and 19th SFTE European Chapter Symposium
7-11 September 2009, Linköping and Stockholm, Sweden

REAL-TIME AERODYNAMIC MODEL PARAMETER IDENTIFICATION

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ABSTRACT

In order to get a good simulation environment where flight mechanical system design can be carried out the physics has to be modeled to certain accuracy, i.e., the effects of the forces and moments acting on the aircraft under investigation have to be modeled in the best possible way. There are three main contributors to these forces and moments. The first, mass and inertia determined by weighing the aircraft, and the second, engine effects usually taken from static test, are often considered as being “true”. This leaves the third and final component, the aerodynamics, which often is harder to determine. Usually it is modeled using handbook methods, numerical calculations and wind tunnel tests prior to flight test. All of these methods have their limitations such as geometrical and physical simplifications.

Flight tests have traditionally been looked upon as verification of the simulator models, but lately more and more tests are being dedicated to investigate and estimate aerodynamic parameters. Since flight tests are expensive it is crucial to get out as much information as possible from them. One way to do this is to monitor the behavior of the aerodynamic model vs. the flight test online. This is being done today at Saab, but since the model usually is complex and depends on many parameters it is not easy to determine which parameters should be updated in the model in order to get better agreement between flight test and simulation data. Another important issue is whether the test contains enough information to answer this question!

An online method that estimates aerodynamic parameters in real-time could be useful during tests for surveying the amount of excitation in the collected data, and thus making good model identification possible. In this paper, a frequency domain method for this purpose is described. The method has been tested in a simulator environment where the parameters are known in order to investigate its accuracy and usefulness. Different maneuvers and turbulence settings have been used in the simulations. The method could be especially useful on demonstrator aircrafts which usually are not modeled and tested so thoroughly before flight testing and which may have unusual geometrical configurations where it can be hard to predict the level of excitation needed for identification purposes.

So far the results in the simulator look promising. If the tests in the simulator are successful the algorithm will be implemented in the real flight test environment at Saab.