

Aircraft Simulation Model and Flight Control Laws Design Using Scilab and XCos

FERREIRA DA SILVA, André

<http://linkedin.com/in/andre-ferreira-da-silva-a1b0a7126>, fs.andre@gmail.com

The increasing demand in the aerospace industry for safety and performance has been requiring even more resourceful flight control laws in all market segments, since the airliners until the newest flying cars. The *de facto* standard for flight control laws design makes extensive use of tools supporting numerical computing and dynamic systems visual modeling, such that Scilab and XCos can nicely suit this kind of development.

Based on the author experience (in at least two important aerospace companies), the aircraft model (F16) presented in the book *Aircraft Control and Simulation* (by Stevens & Lewis) was rebuilt using two approaches: (1) pure Scilab scripts (version 6.0.1) and (2) XCos models. The original code extracted from the book (written in Fortran) was modularized in smaller parts (engine, aerodynamics, atmosphere, equations of motions) for each approach. In the Scilab scripts version, these modules were separated by script files and functions; in the XCos model, these modules were separated in different subsystems. This was thought to allow changing the model to simulate a different aircraft, for example, or the same aircraft with different modules (for instance, different engines). Performing some simulations to validate the models, the results from both approaches were compared to each other and with the results of the examples in the book. The scripts version was used to develop a very simple pitch rate controller and a linear analysis was performed to assess the stability.

The presented work showed the feasibility of Scilab use in the flight control laws design. Despite of the simplicity of the aircraft model built here, we show how far (or near) we are from the models and tools currently in use by the industry and also we try to enumerate the possible challenges to make it conform. Alongside this we shortly point out the comparison between the two approaches to develop the aircraft model: by scripts and by XCos diagram.

The source code can be found at [1] and a more detail explanation can be found at [2].

[1] <https://github.com/fsandre/mcflight>

[2]

<https://medium.com/@fsandre/six-dof-nonlinear-aircraft-model-challenges-in-software-development-e4ede49f7bfa>