

Enhanced Flight Dynamics Model to Simulate the Aircraft Response to Gust Encounters

Authors : Castells Pau, Poetsch Christophe

Abstract : The effect of gust and turbulence encounters on aircraft is a wide field of study which allows different approaches, from high-fidelity multidisciplinary simulations to more simplified models adapted to industrial applications. The typical main goal is to predict the gust loads on the aircraft in order to ensure a safe design and achieve certification. Another topic widely studied is the gust loads reduction through an active control law. The impact of gusts on aircraft handling qualities is of interest as well in the analysis of in-service events so as to evaluate the aircraft response and the performance of the flight control laws. Traditionally, gust loads and handling qualities are addressed separately with different models adapted to the specific needs of each discipline. In this paper, an assessment of the differences between both models is presented and a strategy to better account for the physics of gust encounters in a typical flight dynamics model is proposed based on the model used for gust loads analysis. The applied corrections aim to capture the gust unsteady aerodynamics and propagation as well as the effect of dynamic flexibility at low frequencies. Results from the gust loads model at different flight conditions and measures from real events are used for validation. An assessment of a possible extension of steady aerodynamic nonlinearities to low frequency range is also addressed. The proposed corrections provide meaningful means to evaluate the performance and possible adjustments of the flight control laws.

Keywords : flight dynamics, gust loads, handling qualities, unsteady aerodynamics

Conference Title : ICAFD 2018 : International Conference on Aircraft Flight Dynamics

Conference Location : Chicago, United States

Conference Dates : October 10-11, 2018