‘Real Time Prediction of the Flutter Onset Speed: Flutter Margin and Non-Linearities’

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Abstract: During the last decade, Computational Fluid Dynamic Methods have been successfully applied to Aeronautics. Particularly, those Methods have been implemented in order to determine the Flight Envelope with diverse results. The Flight Envelope states the conditions where an aircraft is safe to fly and those conditions must be carefully determined. That is why, even today, Flight Test is the only reliable method to define the Flight Envelope, specially in the conditions where the numerical modelization reaches great complexity (non-linearities). However, Flight Test is expensive and different Procedures must arise in order to match reliability (Safety) and cost (Flight Hours). This dilemma is even worst when free-flutter conditions must be provided for a new aircraft or a new external configuration, because the Envelope expansion is done by increasing the Flight Test Hours.

The present article shows a Procedure to predict the flutter speed based on real-time tuning of a Quasi Non-Linear Aeroelastic Model. A two-dimensional non linear (freeplay) aeroeslastic model is implemented in MatLab/Simulink with incompressible aerodynamic conditions. A comparison with real compressible conditions is provided. Once the numerical validation is accomplished, a parametric Aeroelastic Model is built in order to describe the proposed Procedure and contribute to reduce the number of Flight Hours to expand the flutter envelope.