# WORK OF THESIS
# ABSTRACT

## *Discrete gust loads in a context of aero-structural design for a military tactical transport aircraft*

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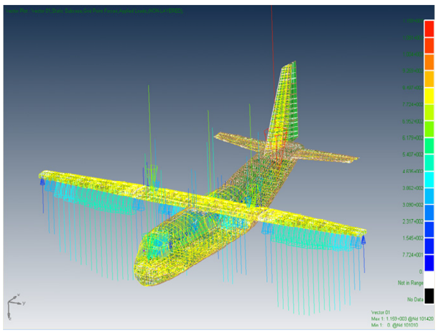

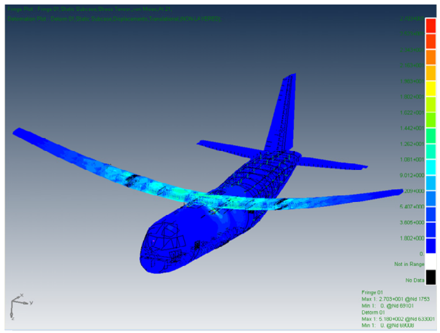

The present work is intended to illustrate a CAE process for the computation of the gust loads of a military tactical transport aircraft, in a context of aero-structural design. The aim is to build up a process as much integrate and accurate as possible. In this work, the static and dynamic aeroelastic behavior of a flexible aircraft has been analyzed using MD Nastran® codes. Starting from the detailed FE model of the aircraft, a simplified structural model has been built (stick-beam) using a routine developed in a Matlab® environment. For the static load cases, symmetric and antisymmetric maneuvers, the aerodynamic and inertial forces have been predicted, and stability derivatives have been determined and correlated with experimental data through an optimization process performed in a ModeFrontier® environment. For the dynamic load cases the aircraft responses, due to discrete gusts, have been calculated in compliance with the JAR25's rules and the external loads have been predicted and enveloped. Finally, using the external loads, stresses and running loads on the detailed FE model have been computed in order to be available for the structure sizing purposes.

Starting from a detailed FEM model (1), we'll go on with the modeling and numerical correlation of a stick-beam structural model through a semi-automatized matlab code (2). Afterword we'll proceed with aerodynamic modelling (3) to build an aerodynamic model compatible with the Doublet Lattice and Vortex Lattice methods. The above models are then connected to build the aeroelastic models (4), which will be then implemented for a static aeroelastic analisys (5) to tune the above-mentioned models on experimental aerodynamic stability derivatives coming from flight tests.
Subsequently the aeroelastic model with the best aerodynamic coefficients will be further improved with corrective coefficients to the aerodynamic found through an optimization process (6).
The model so tuned will be implemented for a dynamic aeroelastic response due to gust (7), from which external dynamic loads will be gained (8).
Finally these loads will be transferred onto the FEM detailed model to obtain internal stresses of the structure, and come back to the beginning of the process.
In this way a typical loop about loads for the structure sizing has been performed for the structural sizing in compliance with JAR 25 Certification Rules.