Project: Anti flutter Demonstrator with Piezoelectric Actuation. Acronym AFDPA

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During the project is developed an advanced active anti flutter control system, vibrations control and implicit, reduce the aerodynamic load effects on aerospace structure. Flutter is a critical phenomenon of the structural vibration which appears suddenly, when the flight velocity increase to a critical value, and can lead to catastrophe, with life loses. Induced dynamic loads, for example, under the influence of the wind gusts, can lead to the structure fatigue and vibrations, shortening the lifecycle of the airplane and lead to unpredictable damages. The proposed system "Anti flutter Demonstrator with Piezoelectric Actuation", Acronym AFDPA, will enlarged the flight envelope of the aircraft, and will contribute to avoid this critical phenomenon, by applying a control law and an advanced algorithm, with sturdiness valences. Implementation of this method requires a special piezoelectric actuator, with wide crossing band, incorporated inside of an "intelligent" aircraft wing, capable to react rapidly and precisely to a signal developed by a controller, avoiding on flight accidents. Team of the project is in a exceptional position for the project, INCAS Institute in collaboration with the partners has an unique expertise, as well as national and international experience in this field.

The active control of flutter vibrations and aero elastic load dumping become just recently implementable once with technological revolution brought by active piezoelectric materials and their use in intelligent structures. Specialty literature present different solutions for active control of the vibrations of helicopter's blades, some of them tested in flight. However, this applications does not exist for fixed wing appliances, because of the overcome technical difficulties: high torque stiffness and angular movement hard to develop by conventional piezoelectric actuators. This technological challenge will be solved by applying of one maximizing energy concept induced by a control signal, in the presence of aerodynamic amplification effect. This implies the existence of an actuator with wide range transmission, otherwise the system become instable. This assume the existence of an wide range passing actuator, otherwise the system become instable, because of that will be assure a range passing at least 30 Hz, and the control law will assure a high stiffness of the system. The project develop a simple smart flap solution, in which the piezoelectric actuator act directly on the command surface through an linear rotary adequate range amplifier. The MLE stiffness control algorithms are very important and they will assure the success of the project. The team expertise, in aerodynamic tunnel tests and in the field of applied control, represent an important base point in this ambitious and complex project.

The final products of the project will be the new methodology and "Anti flutter Demonstrator with Piezoelectric Actuation" which will confirm an experimental smart wing solution with active control of: flutter, vibration and decrease of aero elastic dynamic loads effects. This project will place the Romanian research in this field in an advantage position, on European an international plan, and that will lead to increase the TRL index of the project's technologies, patentable solutions and wide industrial applications.

The project has as objectives:

1. Piezo electric actuator for servo tab/flap

2. Stiff active control law for vibrations damping

3. AM wing model for aero dynamic tunnel testing (as hardware)

4. Vibration active control with piezo electric actuator

5. AFDPA system