STS-06

Disruptive Aircraft's Wing Configurations towards Climate Neutrality

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The present STS at ECCOMAS 2022 will include five contributions concerning novel wing morphing, able to drastically increase the aerodynamic performances leading to a considerable fuel's consumption decrease and noise sources reduction**.** The presentations analyse the morphing effects on the fluid-structure interaction, beneficially manipulating the surrounding turbulence towards drag reduction, increase of lift and noise attenuation. The new morphing designs ensure a considerable energy decrease for the propulsion, beneficial for all sources of renewal energy.

These studies are a continuation from the EU project SMS, "Smart Morphing and Sensing" for aeronautical configurations within Horizon2020 (contract N° 723402) and from the French ANR "Agence Nationale de Recherche" project EMBIA, "Electrical Multiphase Bionspired Live-skin Interfaces in Aeronautics".

The presentations included in this STS analyse through High-Fidelity numerical approaches, the effects of spatial and temporal modulation of the actuation frequencies and amplitudes applied through novel smart actuators disposed in a distributed way on the "skin" of the lifting structure. These designs are able to produce optimal interfacial layers interacting with the coherent and chaotic turbulence structures and applying deformation of strategic parts of the wing.

The topic of this session prepares future wing design for aeronautics industrial applications aiming at saving energy and at reducing the pollution through these new, *multiple-degrees-of freedom morphing concepts*, enabling a considerable reduction of emissions, meeting the targets fixed by Flightpath 2050: Europe's Vision for Aviation [1].

[1] European Commission, DG MOVE/ DG RTD, Flightpath 2050: Europe's Vision for Aviation: Maintaining global leadership and serving society's needs, Publications Office, 2012, https://data.europa.eu/doi/10.2777/15458

List of presentations:

Numerical simulation of a morphing wing of A320 type, through multi-parametric wobulation in the vicinity of the trailing edge in subsonic regimes
Clément Rouaix, César Jimenez-Navarro, Abderahmane Marouf, Mateus Carvalho, Horia Hangan, Jean-François Rouchon, Marianna Braza ; clement.rouaix@imft.fr, marianna.braza@imft.fr

Numerical simulation of the aerodynamic performance of a supercritical wing subjected to a hybrid electroactive morphing associating cambering and multi-parametric vibration effects
Clément Rouaix, César Jimenez-Navarro, Abderahmane Marouf, Mateus Carvalho, Jean-François Rouchon, Marianna Braza; clement.rouaix@imft.fr, cesar.jimeneznavarro@imft.fr

Numerical simulation of the aerodynamic performance of a morphing wing in the transonic regime
Cesar Jimenez-Navarro, Clément Rouaix, Abderahmane Marouf, Alexandre Ninet, Yannick Hoarau, Marianna Braza; cesar.jimeneznavarro@imft.fr

Electroactive morphing effects through travelling wave actuation on the aerodynamic performance of a morphing wing by means of numerical simulation
Abderahmane Marouf, Rajaa El Akoury, César Jimenez-Navarro, Alexandre Ninet, Yannick Hoarau, Marianna Braza; amarouf@unistra.fr, elakoury@imft.fr

Flow analysis around a high-lift wing-flap system and application of Active Flow Control to enhance the aerodynamic performances at high Reynolds number
Yannick Hoarau, Abderahmane Marouf, Hung D. Truong, Alain Gehri, Dominique Charbonnier, Jan. B. Vos; amarouf@unistra.fr, hoarau@unistra.fr