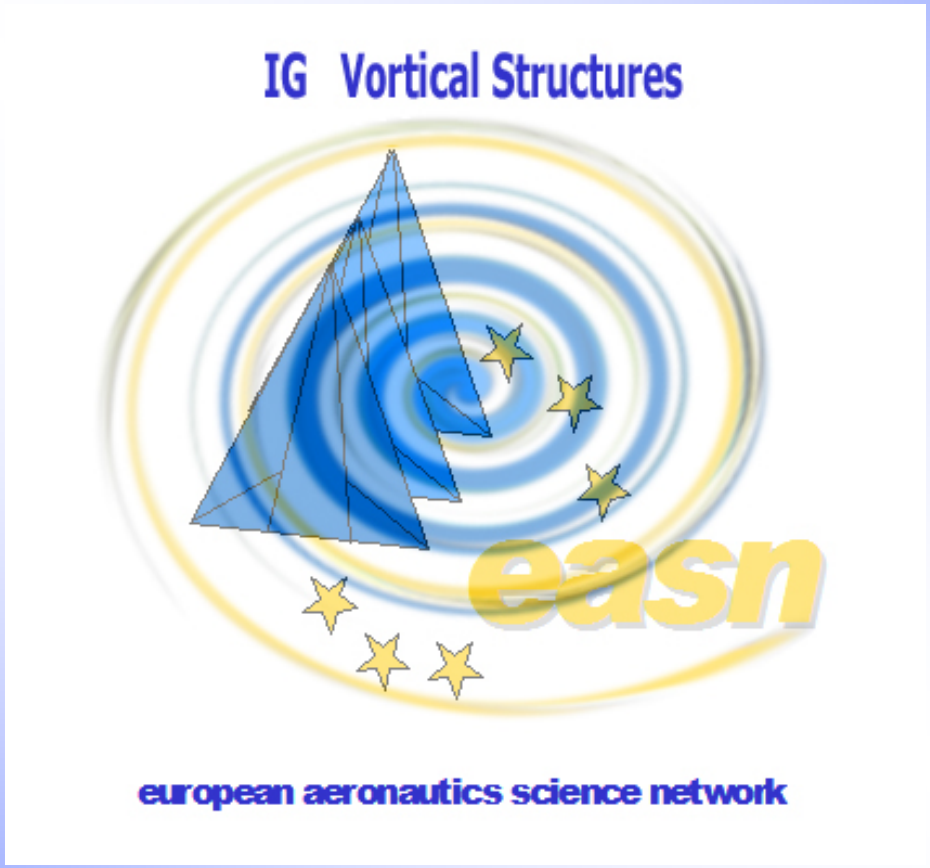
European Aeronautics Science Network



IG : Vortical Structures in Aeronautics

- Coherent vortical structures play a significant role in many fields of Aeronautics (wing tip vortex, vortex shedding, swirling combustion systems to name a few)
- Organized vorticity is a topic that defies in many areas “intuitive engineering” approaches as commonly applied in technology applications.
- There is a lack of understanding of the physics and of the scientific tools to face the problems.

The objectives of the IG on “Vortical Structures” are to initiate, organize and conduct systematic research addressing in parallel both fundamental and engineering aspects of vorticity by employing existing and under development advanced methodology in experiment and computation.

Topics of interest

Structures and Dynamics of
Organized and Chaotic Vorticity –

Basic Aspects

- Generation, Dynamics and Decay of Large Scale Coherent Vorticity.
- Vorticity-Velocity Field Interaction.
- Effect of straining on organized and chaotic vorticity-vortex pairing reverse cascade.
- The concept of helicity – representation of large scale vortices, effect of helicity on turbulence structure and dynamics.
- Flow topology.
- Effects of organized vorticity on flow structure and development.
- Vortex Interaction.
- Role of Vorticity in Turbulent Transport- turbulent mixing, diffusion and entrainment- modeling of turbulent transport.
- Vortex Shedding Mechanism

Topics of interest

Applications

- Vortex Shedding Applications, Vortex Shedding Control
- Trailing Vortices – Vortex Wake
- Swirling Flows
- Lifting Vortices
- Development of Advanced Vorticity Measurement Techniques
- Numerical Vortex Simulations

Partners

Aristotle University of Thessaloniki
University of Bath
Budapest University of Technology and Economics
Cranfield University
Ecole Nationale Supérieure de Mécanique et d'Aérotechnique
Czech Technical University Prague
University of Liverpool
Associated Technical University Graz
National Research Institute for Textile & Leather Bucharest
Instituto Superior Técnico
University of Karlsruhe
Laboratoire de Mécanique de Lille
Norwegian University of Science and Technology
National Technical University of Athens
Politechnico di Torino
Tel Aviv University
National Technical University of Athens
University of Patras
University of Saarland
University of Thessaly
Vilnius Gediminas Technical University
University of Sheffield
Chalmers University of Technology

Research Institutes
ONERA
DLR
Swedish Defence Research Agency, FOI
Industry
Dassault Aviation
EADS

Research Proposed by Partners during FP7 calls

CFD analysis of vortex induced lift
Unsteady Aerodynamic Flows: Advanced Modelling and Simulation towards Reliable and Robust Industrial Applications
Development of reduced mathematical models for fast engineering flow control predictions
Unsteady Aerodynamics of Spoiler-Flap Combination
CFD Fusion Strategy for Integration of Simulation and Experiments
Trailing-edge jet flap control of vortices developing on the surface of a Delta wing
Influence of Vorticity on Porous Membranes
Advanced concepts and technologies for flow control
ENSMA proposal
Study of fluidic vortex generators for flow control
Rotor/Stator Interaction
Subsonic flow over cavities with aeronautical application
Micromechanical hot wire sensor systems for measuring vorticity
EoIs submitted to EASN as Interest Group Vortical Structures proposals
Advanced concepts and technologies for flow control
Unsteady Aerodynamic Flows: Advanced Simulation Strategies for Aeronautical Applications

Advanced Concepts & Technologies for Flow Control
ADFLOCO
Collaborative Project

Abstract

The potential of passive and active flow control to improve the aerodynamic performance of the aircraft and the efficiency and environmental impact of propulsion systems promises significant benefits leading to a more green and cost efficient aircraft. For these promises to become true significant steps have to be done.

A coordinate research action is proposed addressing the issue of passive and active flow control from first principles to the development of theoretical and numerical design tools and assessment of typical and novel flow control device concepts. To support this action significant experimental effort and numerical model development are foreseen.

ADFLOCO
Concept and objectives

ADFLOCO focuses on both the fundamental and practical aspects of flow control. Significant progress has been made during the last few years in this area, and several recent and current projects have contributed important results. The flow control issue appears to be of high priority in the Industry agenda and new projects including novel flow control aspects in their scope are certainly needed. Yet, the "art of flow control" remains to a large extend the area of trial and error techniques and new development of new concepts often relies on intuition and brute force. Clearly, however, development and investigation based on such an approach is expected to be able to provide only fractions of the benefits promised by flow control. In this environment, ADFLOCO is making a step back to fundamental aspects and theory in order to give renewed momentum to this area.

The high-level objectives of the ADFLOCO project

- Address the theoretical foundation of flow control
- Control Device Evaluation and Development
- Sensor Evaluation and Development
- Numerical Tools Evaluation and Development

ADFLOCO
Partners

1	University of Patras (**UP**, Coordinator)
2	Aristotle University of Thessaloniki (**AUTH**)
3	Cranfield University (**Cranfield**)
4	Deutsches Zentrum für Luft- und Raumfahrt e.V. (**DLR**)
5	EADS Deutschland GmbH (**EADS**)
6	Ecole Nationale Supérieure de Mécanique et d'Aérotechnique (**ENSMA**)
7	Swedish Defence Research Agency (**FOI**)
8	KLEOS S.A. (**KLEOS**)
9	National Technical University of Athens (**NTUA**)
10	Nanjing University of Aeronautics and Astronautics (**NUAA**)
11	Office National d'Etudes et de Recherches Aérospatiales (**ONERA**)
12	Tel Aviv University (**TAU**)
13	University of Bath (**UB**)
14	Chalmers Tekniska Hoegskala AB (**UCH**)
15	Saarland University (**UniSaar**)
16	Universidad Politécnica de Madrid (**UPM**)
17	University of Sheffield (**USH**)
18	Vilnius Gediminas Technical University (**VGTU**)