ANIMA

Aviation Noise Impact Management through Novel Approaches

D6.7 – Proceedings of the ANIMA 2nd Scientific Workshop

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1 Use one of the following codes: R=Document, report (excluding the periodic and final reports)
DEM=Demonstrator, pilot, prototype, plan designs
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2 Use one of the following codes: PU=Public, fully open, e.g. web
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1 Introduction

The present document contains the report of the Annual Network Event and Promotion of Research Effort and the 2nd Scientific Workshop sponsored by ANIMA WP6. The 2019 edition of the events has been hosted by the Department of Engineering of the Roma Tre University, on September 25-27 2019. The next section contains a short report of the scientific workshop, as well as the link to the repository of the technical presentations.

2 The Workshop '*NEW MATERIALS FOR APPLICATIONS IN AEROACOUSTICS*'

The workshop was focused on innovative active and passive materials for the reduction of noise in aeroacoustic applications.

Aspects related to theoretical and numerical modelling, advanced design and manufacturing techniques, and dedicated experimental approaches were of relevance to the workshop objectives.

Primary goal of the workshop was to encourage the discussion and the cooperation of the research community on this key topic, aiming at the identification of breakthrough concepts, in order to achieve the substantial noise reduction required to guarantee the sustainable development of the aeronautical transportation system.

The suggested topics were:

- Innovative active and semi-active concepts
- Space-coiling metasurfaces
- Poro-elastic materials
- Active and passive metamaterials
- Theoretical and numerical modelling of new materials
- New design and manufacturing techniques
- Experimental techniques for innovative materials

All additional information can be found on the website developed for the workshop: https://ceas-asc-workshop-2019.ing.uniroma3.it/

3 Programme of the Workshop

At the Workshop were presented the 23 abstracts accepted by the Scientific Committee (on a total of 27 abstracts received) and 4 keynote lectures. Approximately 70 people have attended.

The keynote lectures were:

- Wim Desmet: "Locally resonant vibro-acoustic metamaterials for compact lightweight noise control engineering solutions."
- Wonju Jeon: "Acoustic Metamaterials and Metasurfaces: Effect of Flow and Visco-thermal Losses."
- Estelle Piot: "Advanced identification techniques an ddesign tools applied to innovative aeroacoustic liners."
- Francesco Asdrubali: "Sustainable materials and metamaterials for acoustical applications."

The presentations were organized in five sessions:

Session 1: Theoretical and Numerical Modelling 1 (Chair: Lorenzo Burghignoli, Roma Tre University)

- S. Pallejà-Cabré, B.J. Tester, R.J. Astley, H. Bério: "Fan noise suppression with Over-Tip-Rotor liners: impedance modelling of acoustically treated circumferential grooves."
- A. Coutant, Y. Aurégan, V. Pagneux: "Slow sound laser in lined flow ducts."
- H. Bodén, Z. Zhang, M.Åbom: "Application of Slow Sound in Ducts."
- A. Celik, A. Gautam, M. Azarpeyvand: "Wavefront Manipulation by Fractal Space-Coiling Acoustic Metamaterials."
- L. Burghignoli, G. Palma: "On the integration of acoustic phase-gradient metasurfaces in aeronautics."
- L. Flanagan, H. Rice, J. Kennedy: "Sub-wavelength acoustic liner via "metamaterials"."

Session 2: Theoretical and Numerical Modelling 2 (Chair: John Kennedy, Trinity College Dublin)

- H. Mao, P. Göransson: "An inverse method for design and characterisation of acoustic materials."
- U. Iemma, M. Carley, P. Göransson: "An integrated approach to the theoretical and numerical modelling of metamaterials for aeroacoustics."
- I. Bashir, C. Courtney, M. Carley: "Development of novel, light-weight and multifunctional acoustic metamaterials metasurfaces for aeronautical applications using 3D Boundary Element Method (BEM3D)."
- C. Sandu, M. Deaconu: "Advanced considerations on using the vacuum as a 'material' in aeroacoustics."

- A. McKay, I. Davis, G. Bennett: "An optimised sub- wavelength segmented membrane sound absorber."

Session 3: T.E. Noise Mitigation (Chair: Lars Enghardt, DLR)

- L. Rossian, J. W. Delfs, R. Ewert: "Numerical Investigation of Porous Materials for Trailing Edge Noise Reduction."
- K.S. Rossignol, A. Suryadi, M. Herr, J. Schmidt: "Experimental Investigation of Porous Materials for Trailing-Edge Noise Reduction."
- C. Teruna, F. Avallone, D. Casalino, D. Ragni, A. Rubio-Carpio, F. Manegar, T. Carolus: "Trailing Edge Noise Reduction with Permeable Materials: Description of Noise Scattering Mechanism."
- A. Rubio Carpio, S. Luesutthiviboon, R. Hedayati, F. Avallone, D. Ragni, M. Snellenm, S. van der Zwaag: "3D-printed Permeable Trailing Edges for Broadband Noise Abatement."

Session 4: Manufacturing and Experimental Assessment (Chair: Mahdi Azarpeyvand, University of Bristol)

- D. Radulescu, M. Deaconu: "Experimental validation of an ultra-open metamaterial which uses the acoustic black hole principle."
- H. Bodén, S. Sack, S. Jacob: "A Study on 3D-printed and Segmented Liners."
- L. Dowling, D. Heaphy, D. Trimble, J. Kennedy; "Repeatability in additive manufacturing for metamaterials."
- K. Knobloch, L. Enghardt, F. Bake: "Flexible Walls for Acoustic Liners."

Session 5: Active and Tunable Concepts (Chair: Hervé Lissek, EPFL)

- H. Lissek, R. Boulandet, S. Karkar, M. Collet, G. Matten, M. Ouisse, M. Versaevel: "(Towards an) Active SDOF Electroacoustic Metamaterial for use as an Adjustable Acoustic Liner for Engine Noise Reduction."
- G. J. Bennett, A. Fossorier, H. Magnes: "Tuneable Acoustic Absorption of a Spherical Elastomeric Monopole with Negative Bulk Modulus."
- Y. Aurégan, M. Farooqui, M.E. D'Elia: "Ultra-Thin and In-Parallel perfect sound absorbers."
- Y. Auregan, M. E. D'Elia, T. Humbert: "Effect of flow on the acoustic behavior of a vibrating cantilever beam liner."

The detailed schedule of the workshop can be downloaded from

https://ceas-asc-workshop-2019.ing.uniroma3.it/?page_id=219

All the keynotes and presentations can be downloaded on the CEAS-ASC Workshop 2019 website, at the following link:

https://ceas-asc-workshop-2019.ing.uniroma3.it/?page_id=903

Currently, a special issue on the *International Journal of Aeroacoustics* dedicated to the workshop is in preparation. The issue will include selected papers based on the workshop presentations. The special issue is expected to be published on late spring 2020.