SPECIAL ISSUE OF THE ROMANIAN JOURNAL OF TECHNICAL SCIENCES. APPLIED MECHANICS

125th anniversary of the birth of Acad. Elie Carafoli

The field of aerodynamics and fluid mechanics has been fundamentally shaped by the pioneering work and invaluable contributions of the great scientific personalities who laid the foundations of modern aeronautics. In this context, the complex personality and achievements of Academician Elie Carafoli remain a benchmark for both national and international engineering research.

Over more than half a century of scientific activity, Professor Elie Carafoli authored a large number of works in the fields of fluid mechanics and aerodynamics, and trained numerous researchers in these areas who made valuable contributions on an international scale.

The dissemination of these results was ensured through the journals *Studii și cercetări de mecanică aplicată* and *Revue Roumaine des Sciences Techniques – Série de Mécanique Appliquée*, where Professor Elie Carafoli served as editor-in-chief from their foundation until the end of his life. These journals attracted numerous specialists from all over the world.

This special issue brings together a series of papers produced by researchers driven by a continuous desire to explore, develop, and extend the frontiers of fluid mechanics, advanced aerodynamics, and space mechatronics. Rather than following a sequential structure, this volume is designed as a single unified section that harmoniously combines theoretical contributions with experimental approaches and modern applications in the aerospace industry. The articles cover a broad range of topics, numerical simulation methods, wind tunnel validation, and cutting-edge technological implementation.

Nearly a century ago, Elie Carafoli established the theoretical foundations of aerodynamic profiles with a rounded trailing edge (known internationally as Carafoli profiles) and developed the monoplane wing theory – fundamental works that definitively influenced aircraft design. Continuing this rich tradition of excellence and innovation in Romanian aeronautical research, contemporary studies extend the boundaries of the field toward the modern challenges of aviation. In this context, the paper *Simulation capability for special operations in non-segregated airspace*, authored by Ana-Maria Bordei and Cătălin Nae, brings a new perspective on operations in non-segregated airspace. This work provides a comprehensive overview of the use of virtual simulation environments for testing complex aerial operations.

Engineer Octavian-Mircea Crișan from ATNOM, alongside researcher Ionuț Bunescu and the team from INCAS Bucharest, proposes an evaluation model for the aerodynamic characteristics and flight dynamics of a general aviation aircraft modified for electric propulsion integration. This paper evaluates the aerodynamic features and flight dynamics of a general aviation aircraft modified through the addition of a ventral

battery container, demonstrating that the new configuration maintains satisfactory stability and efficiency, thus representing a viable demonstrator platform for electric propulsion integration.

The paper *Uncertainty Propagation for Wind Tunnel Data Post-Processing: Application to a Test Model* brings a valuable contribution to experimental aerodynamics through research conducted by young researcher Theodor Drăghici under the guidance of Prof. Crunțeanu, together with the INCAS team coordinated by Ionuț Bunescu and Gilbert Stoican.

Researcher Tudor Gabriel Gagiu, along with the INCAS team, designed an innovative electromechanical actuation system intended for the optional integration of an autopilot on ultralight aircraft. This achievement makes a valuable contribution to the development of light aviation by providing a modular and accessible solution to increase flight safety and reduce pilot workload without compromising the structural performance of the aircraft.

Researcher Tudor Gheorma, together with Khaled Hachem, makes a remarkable contribution through the paper *"Development and experimental validation of a general-purpose flight controller for autonomous aerospace platforms"*. This research supports the development of modern navigation and automatic control systems by providing a general-purpose autopilot architecture that has been experimentally tested and validated across multiple types of aerial platforms (ranging from multicopters to fixed-wing aircraft and VTOL systems).

Through the paper *"ArduPlane Based Avionics"*, authors Khaled Hachem and Ion Andrei bring a valuable practical contribution to aviation and autonomous systems by developing a software module for real-time aircraft state display.

The paper *Assessment of Static Divergence and Flutter Characteristics for a Canonical Geometry* – authored by Mihăiță-Gilbert Stoican, Theodor-Andrei Drăghici, Ionuț Bunescu, Mihai-Vlăduț Hothazie, and Mara Negoiță, under the coordination of Prof. Teodor-Viorel Chelaru and Dr. Eng. Mihai-Victor Pricop (INCAS) – addresses a critical topic for structural safety in aeronautics: the prevention of aeroelastic instabilities. By developing a simplified two-degree-of-freedom model (bending and torsion) based on Theodorsen's theory and FEM analysis, the research provides a fast and coherent tool for assessing critical flutter and divergence speeds, proving especially useful during the conceptual design phase and wind tunnel test preparation.

In closing, through their contributions to electric aviation, modern avionics, airspace simulation, and aeroelasticity, the authors of this special issue of the *Romanian Journal of Technical Sciences – Applied Mechanics* express their deep gratitude for the opportunity to pay tribute to the memory and legacy of Academician Elie Carafoli. Special thanks are addressed to the leadership of the Romanian Academy and the Editorial Board, whose continuous support made the publication of this commemorative issue possible.

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