PhD Position in Aeronautics Engineering (VAC-2021-26)

Title of the PhD project: Robust Optimization to improve efficiency of Air Transportation

INTRODUCTION:

The International Centre for Numerical Methods in Engineering (CIMNE, www.cimne.com) is a research centre, created in 1987 by consortium between the Catalan Government and the Universitat Politècnica de Catalunya (UPC-BarcelonaTech), devoted to the development and application of numerical methods to a wide range of areas in engineering. CIMNE has been selected as a Severo Ochoa Centre of Excellence for the period 2019-2023, the highest level of recognition of excellence and leadership awarded to a research centre in Spain.

POSITION DETAILS

Number of vacancies: 1
Category: PhD (PHD2)
Location: BCN - Castelldefels
Yearly salary (gross): 17.563,14 EUR
Working hours: Full time
Duration: 3 years
Starting date: No later than Sept 2021

FUNCTIONS TO BE DEVELOPED BY THE APPLICANT

CIMNE is looking for a **PhD Researcher** to be part of the Research and Technical Development (RTD) Group on Aeronautics Engineering.

The functions assigned to the candidate will be:

- Complete a PhD on Aerospace Science and Technology at Universitat Politècnica de Catalunya – Barcelona Tech. The candidate is expected to complete the PhD thesis in a maximum of three years.
- Collaborate with various research groups within CIMNE and worldwide.
- To publish a minimum of two papers in JCR journals during the PhD period, author and co-author articles in high-impact international journals.
- Carry out quality research, training and management.
- Participate on the dissemination and outreach activities associated with the project.
- Participate in international conferences presenting her/his work.

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DESCRIPTION OF THE PHD PROJECT:

The research proposal is aiming to investigate the development, implementation and application of uncertainty quantification (UQ) and propagation methods into the ATM field (for instance for air traffic flow management purposes, conflict detection resolution algorithms, air-ground traffic synchronisation algorithms, etc.) but also into the aircraft operations world (for instance to generate robust flight plans, or take more informed decisions when amending a flight plan either before its submission or once the aircraft is flying). Weather and performance uncertainties will be tackled, but not limited to. Network uncertainties will be also analysed and incorporated, linking with complexity concepts.

The ultimate goal of this PhD is to contribute to enhance the flight efficiency of the aircraft operations, thus reducing the environmental impact but also the cost for airlines; to increase airspace capacity, reducing delays and re-routings; and contributing to increase the overall safety, robustness and resilience of the ATM system.

Potential outcomes of the research include the implementation of UQ techniques and optimization methods enabling the robust optimization of air transport operations; from movements on and around airports to full flight trajectories. Another outcome could be a procedure or even a tool helping flight dispatchers to adjust the flight parameters to the actual conditions (weather, restrictions and regulations, but also congestion of air space sectors).

References

González-Arribas, Daniel; Sanjurjo-Rivo, Manuel; Soler, Manuel. Multiobjective Optimisation of Aircraft Trajectories Under Wind Uncertainty Using GPU Parallelism and Genetic. Evolutionary and Deterministic Methods for Design Optimization and Control With Applications to Industrial and Societal Problems, 2018, 49: 453.

García-Heras, Javier; Soler, Manuel; González-Arribas, Daniel. Characterization and Enhancement of Flight Planning Predictability under Wind Uncertainty. International Journal of Aerospace Engineering, 2019.

Pons-Prats, Jordi; Bugeda, Gabriel; Zarate, Francisco; Oñate, Eugenio; Périaux, Jacques. Applying multi-objective robust design optimization procedure to the route planning of a commercial aircraft. Computational Methods and Models for Transport. Computational Methods in Applied Sciences. Diez, P. Neittaanmäki, P., Periaux, J., Tuovinen, T., Bräysy, O. (Eds.), Vol. 45, pp. 147-167, Springer, Cham URL, 2018.

REQUIREMENTS

1. Good mathematical background, and deep knowledge of algebraic concepts to work with partial differential equations is required.
2. Good programming skills, preferably C++ and Python programming languages.
3. Sound knowledge about Air Traffic Management (ATM), trajectory prediction, and trajectory optimization.
4. Sound knowledge about mathematical optimization methods, as well as graph methods. Uncertainty quantification and propagation techniques.

EVALUATION OF CANDIDATES

The requirements and merits will be evaluated with a maximum mark of 100 points. Such maximum mark will be obtained by adding up the points obtained in the following items:

- Academic record (60%)
- Previous research and academic experience in the field of the position (20%)
- Programming skills (10%)
- Language skills (10%)

HOW TO APPLY

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the following documents **in English**:

- Curriculum vitae
- A motivation letter
- Academic transcripts from all Undergraduate and MSc degrees
- Name and institutional contact information of two possible referees

The deadline for registration to the offer ends on 31st May, 2021 at 12 noon.

The shortlisted candidates may be called for an interview. They may also be required to provide further supporting documentation.

CIMNE is an equal opportunity employer committed to diversity and inclusion. We are pleased to consider all qualified applicants for employment without regard to race, colour, religion, sex, sexual orientation, gender identity, national origin, age, disability or any other basis protected by applicable state or local law. CIMNE has been awarded the HRS4R label.