



PhD Position in Active Flow Control, Artificial Intelligence and Embedded Real-Time Hardware

Applications are invited for a 4-year PhD position at the Spanish Institute of Aerospace Technology, INTA, within the Aerial Platforms Area, under the supervision of Dr Carlos Sanmiguel Vila and in collaboration with the University of Granada for FPGA and embedded-system implementation.

The PhD project lies at the interface between experimental aerodynamics, artificial intelligence, reduced-order modelling, closed-loop control and real-time hardware. The main objective is to develop and experimentally validate active flow control strategies in a wind tunnel for aeronautical applications, integrating pressure sensors, fluidic actuators, state estimators, reduced-order models and machine-learning algorithms able to operate in real time. The project will place particular emphasis on **Model Predictive Control, MPC, Reinforcement Learning, RL**, adaptive control and hybrid data-driven control strategies to autonomously modify flow dynamics from partial measurements. The thesis will contribute to the development of embedded aerodynamic control capabilities for future aerial platforms that are more efficient, robust and intelligent.

The selected candidate will contribute to activities such as:

- Reviewing the state of the art in active flow control, closed-loop control, reduced-order modelling, machine learning, state estimation, **Model Predictive Control, Reinforcement Learning** and embedded hardware.
- Designing, preparing and conducting active flow control experiments in a wind tunnel.
- Participating in experimental campaigns involving pressure sensors, force measurements, anemometry, Particle Image Velocimetry, infrared thermography or other diagnostic techniques.
- Developing reduced-order models and flow-state estimators from partial measurements, with particular emphasis on wall-pressure sensing.
- Exploring machine-learning techniques, autoencoders, recurrent neural networks, predictive models and system-identification approaches for flow prediction.
- Formulating and implementing closed-loop control strategies, with special emphasis on **Model Predictive Control, Reinforcement Learning**, adaptive control and hybrid data-driven approaches.
- Implementing control algorithms on FPGA or System-on-Chip platforms, integrating data acquisition, filtering, estimation, decision-making and real-time actuation.
- Experimentally validating the complete sensing, estimation and control loop under steady and unsteady flow conditions.
- Writing scientific journal papers, international conference contributions and the PhD dissertation.

We are looking for candidates with:

- An MSc degree in aerospace engineering, mechanical engineering, control engineering, physics, mathematics, computer science, telecommunications or related disciplines.
- A strong interest in applying artificial intelligence to real physical systems.
- A solid background in fluid mechanics, aerodynamics, control, signal processing or scientific computing.
- Programming skills in Python, MATLAB or similar scientific-computing environments.
- Interest in machine learning, neural networks, reduced-order modelling, **Model Predictive Control, Reinforcement Learning** or system identification.
- Motivation to combine experimental laboratory work with algorithm development.
- Ability to work independently and proactively, together with critical thinking, scientific creativity and good teamwork skills.
- Good oral and written English skills.



What we offer

- 4-year PhD contract.
- Annual gross salary of **€25,500**, subject to annual salary increases in accordance with those established for Spanish public-sector employees.
- 35-hour working week.
- Integration into a young, dynamic and multidisciplinary team within the Aerial Platforms Area at INTA.
- A research line combining experiments, scientific computing and artificial intelligence.
- Flexible and collaborative working environment.
- Opportunities to participate in experimental campaigns, national and international collaborations and scientific conferences.
- Health coverage under the Spanish National Health System.

How to apply

Interested candidates should send their application to csanvil@inta.es, indicating **INTA-PhD-AI-Flow-Control** in the email subject.