

## Presentation of the tutorials

Two tutorials are proposed on **Tuesday afternoon, November 17, 2020**. The tutorials will be held at INSA Toulouse, 135 Avenue de Rangueil, 31077 Toulouse Cedex 4, France.

The number of places is limited to the first 20 registrations for each tutorial.

The registration fee for one tutorial is **100 € plus VAT**. It includes the coffee breaks and the printed copy of the tutorial slides. Each tutorial will start at **2 pm** am and finish at **5.30 pm**.

### **Tutorial 1. Introduction to predesign of multi-rotor drones with open-source tools, by Associate Professor Marc BUDINGER**

Abstract: The tutorial concerns the use of open-source tools such as python, python scientific libraries, python notebooks and openModelica in order to realize the preliminary design of a multi-rotor drone. The tutorial will show how: to represent datasheet catalogs, FEM simulation, 0D/1D simulations using scaling laws or surrogate models, to associate models in order to size and optimize the overall system with easy to use python packages. There are no specific requirements in simulation or python programming for understanding and achieving the tutorial.

Tutor: Marc Budinger is associate professor at INSA and researcher at Institut Clément Ader in Toulouse. He got in 1998 the Agregation degree in Applied Physics, in 2003 the Ph.D degrees in Electrical Engineering from Institut National Polytechnique de Toulouse and in 2014 the HdR in Mechanical Engineering from Toulouse University. His research activities have included design of electrical submarine propulsion motor, piezoelectric actuators and MEMS. His current research topic deals with the preliminary design of electromechanical aircraft systems (actuators, deicing systems, multirotor drones).

### **Tutorial 2. Virtual prototyping and real-time simulation of electromechanical actuators, by Professor Jean-Charles MARÉ**

Abstract: The tutorial aims at making the delegates more familiar with system-level modelling and simulation of electromechanical actuator. Special attention will be paid to modelling best practices, model architecting, simulation of energy losses and dynamic effects for both electric and mechanical domains. Full electromechanical actuator will be modelled to run virtual tests using a progressive approach. Then, the model will be adapted to meet the constraints of real-time simulation, following a top-down methodology. The tutorial is not software oriented. For this reason, there is no special requirement for a prior experience in simulation. The proposed practices and modelling approaches can be easily re-used within any simulation environment.

Tutor: Pr Jean-Charles MARE is professor at INSA and researcher at Institut Clément Ader in Toulouse In 1993, he got the French Doctorat d'Etat dealing with the modelling, the simulation, the identification and the control of electrohydraulic actuators. Pr MARE has acquired more than 32 years of experience in system level simulation of aerospace actuators and actuation systems. He has been involved in industrial and research projects for commercial aircrafts, helicopters, weapons and test benches. His fields of expertise are mainly the system-level architecting, modelling and virtual prototyping of aerospace actuators. He is the author of a recently published series of 3 books titled *Aerospace Actuators* (ISTE/Wiley editors) He also authored the chapter dedicated to actuation in the SAE Book *Fundamentals of Electric Aircraft* (2018).

*More information on the tutors' current research activities can be found at the Institut Clement Ader website: [www.institut-clement-ader.fr](http://www.institut-clement-ader.fr).*