# Commercial Aviation Electrification: Challenges and Opportunities

## SPEAKERS


**Matilde D'Arpino**
*Research Assistant Professor*
*Ohio State University*


## ABSTRACT


This course will provide an overview on the challenges and opportunities in electrification of commercial aircraft and current state of the art, including more electric aircraft and electric propulsion. Hybrid-electric gas turbine generators and distributed propulsion are considered promising technologies for more efficient and sustainable air transportation. Improved efficiency and reduced emissions are key benefits, that need to balance the weight and cost increase. The selection, proper design and control of the battery technology are key factors to unlock benefits of electrification.

The example of the Ohio State NASA University Leadership Initiative projects will be used to describe possible approaches for the optimization of design and control for hybrid electric aircraft. A modular framework of reduced-order models of hybrid-electric distributed-propulsion system components and systems has been developed and exercised for evaluating the relative performance of different Li-ion cell technologies considering different pack sizes and mission range. Both state-of-the-art and future battery technologies are evaluated, with energy density ranging from 230-400 Wh/kg and power density ranging from 350-1200 W/kg.

This course will then focus on the development of a real-time flight, thermal and propulsion control for the hybrid turboelectric architecture, which guarantees the aircraft to follow the desired mission profile and to determine the control variables for optimally using the battery and the engine in terms of electrical power and cooling requirements. The developed controller is tested and validated in a Controller Hardware In the Loop (CHIL) test setup that includes a realistic model of the airframe, the propulsion system and the physical communication interface between the controller and the propulsor. The robustness of the controller is tested considering signal discretization effects and communication delays.


## About The Speaker:

**Matilde D'Arpino:**
Matilde D'Arpino received the B.S. and M.S. degree in electrical engineering and the Ph.D. degree in 'Systems, technologies, and devices for movement and health' from the University of Cassino, Italy, in 2008, 2010 and 2014, respectively. From 2016 to 2022, she has been a researcher at the Ohio State University Center for Automotive Research, Columbus, OH, USA. Since 2022, she is a Research Assistant Professor in the Departments of Mechanical and Aerospace Engineering and Electrical and Computer Engineering at The Ohio State University. Her research interests include design and control of electric vehicle for automotive and aerospace, power converters and energy management controls for multi-source power systems (e.g. microgrids, hybrid vehicles, hybrid aircraft), testing, modeling, design, control and diagnostic of energy storage systems. Illinois at Urbana-Champaign Institute, Haining, China. He holds 42 U.S. patents. His current research interests include all aspects of power electronics, machines, drives, electric transportation, and electrical energy, with emphasis on nonlinear control approaches.