

Tutorial Title

Electric Propulsion Systems for Electric Aircraft

Instructor Team

Team Chair: Chris Mi, San Diego State University

Co-Speakers:

Abstract

The aviation industry accounts for 9% of greenhouse gas emissions from the transportation sector. To address the emissions, NASA's Subsonic Fixed Wing program has set performance targets at -55dB noise at the airport boundary, -75% NO_x, and -70% fuel burn relative to 2006-era technology. Electric aircraft could be the most viable solution to achieve these goals. In addition, electric aircraft can reduce operating costs by using electricity instead of jet fuel and reducing overall energy consumption. However, adopting electric propulsion for the long-haul and large-capacity aircraft may not be realistic due to reasons such as weight, cost, and charging times of the battery. Hence, a more practical entry point for introducing electric propulsion in aviation is on short-haul and vertical takeoff and landing (eVTOL) aircraft. In the meantime, aircraft is employing more electric usage in its auxiliary systems. For example, eVTOLs are quiet, efficient, emission-free, and no runway is required when compared to traditional aircraft and helicopters, hence, are ideal for urban transportation and emergency services. This tutorial will cover the fundamentals of electric systems in more-electric and pure-electric aircraft, including electric propulsion systems and energy storage. We will also discuss a novel single-turn electric motor for electric aircraft applications.

Instructor Team Biographies

Dr. Mi is the Distinguished Professor of Electrical and Computer Engineering at San Diego State University. He is a Fellow of IEEE and SAE. He was previously a faculty member at the University of Michigan-Dearborn from 2001 to 2015, and an Electrical Engineer with General Electric from 2000 to 2001. Dr. Mi received his Ph. D from the University of Toronto, Canada, in 2001. Dr. Mi has published five books, 220 journal papers, 130 conference papers, and 20+ issued and pending patents. He served as Editor-in-Chief, Area Editor, Guest Editor, and Associate Editor of multiple IEEE Transactions and international journals, as well as the General Chair of over ten IEEE international conferences. Dr. Mi has won numerous awards, including the "Distinguished Teaching Award" and "Distinguished Research Award" from the University of Michigan-Dearborn. He is the recipient of four Best Paper Awards from IEEE Transactions. In 2019, he received the Inaugural IEEE Power Electronics Emerging Technology Award. In 2022, he was named the Distinguished Professor, the highest honor given to a SDSU faculty member. Most recently, he received the 2023 IEEE PELS Vehicle and Transportation Systems Achievement Award. He has delivered numerous tutorials and keynote speeches at IEEE conferences.



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