

General Airgap Field Modulation Theory for Electrical Machines and Its Applications in Automotive and Aerospace Industries

SPEAKERS



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About Us:

ITEC is aimed at helping the industry in the transition from conventional vehicles to advanced electrified vehicles. The conference is focused on components, systems, standards, and grid interface technologies, related to efficient power conversion for all types of electrified transportation, including electric vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles (EVs, HEVs, and PHEVs) as well as heavy-duty, rail, and off-road vehicles and airplanes and ships.

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SUMMARY

Electrical machines are devices that convert mechanical energy into electrical energy or vice versa. They were invented in the 1800s and have a history of nearly 200 years. With the rapid development of our social economy in this electrification era, the demand for high-performance electrical machines and their analysis theories is increasing day by day. This short course will provide a comprehensive overview of airgap magnetic field modulation phenomena widely observed in electrical machines, and the general airgap field modulation theory that has been developed systematically to understand and research them.

ABSTRACT

It will be shown by several examples that the developed theory not only serves to unify analysis of disparate electrical machines, from conventional DC machines, induction machines, and synchronous machines to unconventional flux-switching permanent magnet (PM) machines, vernier machines, brushless doubly-fed machines, etc., but also paves the way towards the creation of new electrical machine topologies.

Starting from overviews of key concepts in electrical machine engineering and in-depth specialized analysis of the novel theory itself, this short course works through applications of the developed theory before proceeding to both qualitative analysis of the theory's operating principles and quantitative analysis of its parameters.

The stator-PM variable reluctance resolver for aviation application and the dual-rotor power-split machine for hybrid electric vehicles invented by the principle of magnetic field modulation are included as two representative examples.

By the end of this short course, attendees will:

Learn about the historical development of electrical machines and their theories, and the ubiquity of magnetic field modulation phenomena; Understand the general airgap field modulation theory framework for design, analysis, and innovation of electrical machines; Be able to apply the general airgap magnetic field modulation theory in qualitative analysis and quantitative calculation of machine performance, and inventing emerging machine topologies to meet various application needs.