附件 1

电动、混合动力汽车电力电子技术及新型燃料电池应用技术高级研修班课程大纲

每日课程结束后有专门时间供参训学员与授课专家进行提问交流

第一讲: Fuel Cell Systems for Transportation and Stationary Power Generation

With the requirements for reducing the emissions and improving the fuel economy, the automotive companies are developing electric, hybrid, and fuel cell vehicles. Fuel cell based vehicles are already in demonstration and in limited production stage. Fuel cells are also being considered for on-board power generation in, trucks, airplanes, and ships. The use of high temperature fuel cells for Stationary Power Generation is getting increasing importance for the distributed power generation and also for stand-alone power systems. Recently with the increasing importance to advance the hydrogen economy, the electrolysis based hydrogen production has made significant technological advancements.

In this seminar, the different fuel cell technologies are examined for transportation and power generation applications. The proton exchange membrane (PEM) fuel cell

based propulsion system architectures for fuel cell vehicles will be presented in detail and simple calculations for the determine the stack size and power will be explained. The power electronics and the control systems are enabling technologies for the advancement of fuel cell based systems. Hence, the operating strategies of fuel cell vehicles with the associated power electronics and control architectures will also be explained.

The operation of Solid Oxide Fuel Cell (SOFC) will be presented and Stationary power generation strategies based on SOFC will be discussed. The power conversion strategies for connecting the fuel cell to grid will also be presented. Simple calculations for determining the fuel requirement for a given power, stack size, and water generation will be presented.

The hybrid fuel cell system consisting of SOFC and Gas turbine system with the associated power conversion and control strategies will be briefly discussed.

In addition, different types of hydrogen based on their production methods will be discussed. Operation of the Alkaline electrolyzer, Proton exchange membrane electrolyzer (PEML), and Solid oxide Electrolyzer (SOEL) will be explained. The efficiency calculations and power converters systems for these electrolyzers will also be

discussed, and will be presented with a few examples.

第二讲: Electric Vehicle Propulsion Systems

In this short course, the following topics will be covered.

1 Introduction to Electric vehicles

2 Propulsion system analysis

   a. Basic mechanics of a vehicle

   b. Energy consumed in a vehicle

   c. Interfacing motor to wheels

   d. Driving cycles and vehicle efficiency

   e. Powertrain component sizing and Examples of powertrain design

3 Power Electronics for Electric vehicles

   a. Power converters for EVs and HEVs

   b. DC-DC and DC-AC converters

   c. Power electronic converters- latest trends

4 Electric Machines and Control for EV and HEVs

   a. Control of induction and PM machines

   b. Maximum efficiency and field weakening operation of induction and PM machines

5 Introduction to Fast Charging of EV batteries

附件 2

电动、混合动力汽车电力电子技术及新型燃料电池应用技术高级研修班讲师介绍

Kaushik Rajashekara (Fellow, IEEE) : received the Ph.D. degree in electrical engineering from the Indian Institute of Science, Bangalore, India. In 1989, he joined the Delphi division of General Motors Corporation in Indianapolis, USA, as a Staff Project Engineer. In Delphi and General Motors, he held various lead technical and managerial positions, and was a Technical Fellow and the Chief Scientist for developing propulsion and power electronics systems for electric, hybrid, and fuel cell vehicle systems. In 2006, he joined Rolls-Royce Corporation, as a Chief Technologist for electric systems for electric and hybrid aircraft systems. In August 2012, he joined as a Distinguished Professor of Engineering with the University of Texas at Dallas, TX, USA. Since September 2016, he has been a Distinguished Professor of engineering in University of Houston, Houston, TX, USA. He has authored or coauthored over 250 papers in international journals and conferences, has 37 US and

15 foreign patents, and has written one book. He has given more than 200 invited presentations in international conferences and universities. He has received a number of awards including the 2022 Global Energy Prize, 2021 IEEE Medal on Environment & Safety Technologies and 2013 IEEE Richard Harold Kaufmann Award for his contributions to electrification of transportation and renewable energy. He was elected as a member of the U.S. National Academy of Engineering in 2012, Fellow of Indian National Academy of Engineering in 2013, and a Member of the Chinese Academy of Engineering in 2021, and a Fellow of the National Academy of Inventors in 2015. His research interests include power/energy conversion, transportation electrification, renewable energy, and microgrid systems.