ELECTRIC VEHICLES - CURRENT STATUS AND FUTURE TRENDS

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Abstract

Electric vehicles are vital technological advancements to reduce greenhouse gas emissions. In the electric automotive industry, traction drive with high power and higher power density is necessary for both Hybrid Electric Vehicle (HEV) and Battery Electric Vehicle (BEV) applications. In the case of HEV, industries are moving from micro-HEV to full-HEV due to a higher fuel economy. However, this technical shift calls for increased power from the battery while reducing power from the conventional engine. Plug-in hybrid electric vehicles and Battery Electric vehicles are gaining marketplace, and many companies are introducing new vehicles to the market in an accelerated fashion. The diversity of requirements, performance, price are noteworthy, and competition and growth in this market will be enormous in the near future.

This tutorial aims to cover electric and hybrid vehicles and review the advancement in motors and power electronics. In this tutorial, an introduction will be given to electric vehicles. Current research and literatüre will be reviewed. Particular emphasis will be provided to achieve higher power density, and various kW/liter metrics will be discussed. The benefits of integrated motor drives will be reviewed. SiC and GaN technology for power converters will be discussed. Current source inverters (CSI) are drawing more attention in improving the overall performance of a motor drive system in terms of increasing the constant power speed ratio (CPSR) and reducing the PWM-induced motor iron losses. Advancements in electric machines for traction drives will be presented.

The second part of the tutorial focuses on the series-hybrid vehicle traction system component sizing. The sensitivity of vehicle performance such as fuel consumption, initial cost, return of investment, to the various choices of traction components is discussed. The relationship between the traction component choice and the vehicle performance is illustrated on an example commercial vehicle.