Multiphase Induction Motor Drives for Gear-Less Electric Vehicle Applications

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Objectives

- Fossil CO₂ emissions in Qatar were 98,990,085 tons in 2016.
- CO₂ emissions increases by 1.79% every year.
- Transportation sector, especially internal combustion engine (ICE) based cars cause for high CO₂ emissions.
- The proposed work is aimed to develop an ecofriendly transportation system, which falls in current research priorities of Qatar University and the state of Qatar.

Why Multi-Phase Machines??

- Enhanced torque-speed range with high efficiency
- High power handling capability
- High torque for starting and high power for high-speed cruising
- High reliability and robustness, acceptable cost
- Volume of the machine
- Low acoustic noise and low torque ripple

Conventional Three Phase Induction Motor Drive for EV

- Gear box is required
- High DC link voltage, for this higher number of batteries are connected in series
- Lower reliability because of the series connected batteries as well less number of phases
- Efficiency is low
- High ratings of devices required
- Higher size of machine, higher number of batteries, requirement of gear because will increase the size of the drive

With Three Phase Induction Motor Drive

- Lesser Space harmonics
- Higher Efficiency
- Reduced rating of the switches
- Improved Fault tolerant capability
- Better Power distribution

Multiphase Machines

Overview of Electric Vehicle with multiphase Induction Motors

- Gear box is eliminated because the machine itself providing enhanced torque speed profile similar to IC engine
- Higher reliability due to the parallel connected batteries and higher number of phases
- Efficiency is high
- Lower DC link Voltage
- Better power distribution/phase
- Reduced ratings of devices required

Experimental results under IFOC vector control of 9-Phase Pole Phase Modulated IM Drive

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