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Examining the Main Elements of Electric Vehicle Mobility

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A B S T R A C T

In the field of electric vehicles, extensive research is being done. The research being done is examined from several angles. The investigations on various electric car components are addressed in this essay. Environmental factors, motor and converter design and control, and energy storage system technologies and strategies have all been looked into. The literature is utilized to present the switching topologies of the converters employed in the EVS.

Keywords: Electric Vehicle, Mobility, design

1. Introduction

The overuse of natural resources, which leads to an increase in hazardous emissions, is one of the main global concerns. The development of energy policies has been touched at all levels by this heightened environmental concern. Statistics show that auto mobility is the main cause of this pollution [1], hence the transportation sector developed models with a constrained range, low fuel consumption, and low emissions. Both conventional and electric auto mobility have seen a lot of research and presentation over the past ten years. Modern advancements in conventional auto mobility include the driver's comfort, reverse radar, traffic vigilance, and engine efficiency. In opposition to these advancements, research is being done on electric vehicles that lack autonomy as a result of stagnant battery and energy storage technology development, energy/power density, automation, higher power electronic presence, reverse power flow, V2G mode operation, etc. [2] More complex electrical equipment is harder to integrate into the electric car as a result of this lack of power storage. This makes driving less comfortable. In addition to the size, weight, efficiency, and autonomy of the vehicle, there are a few more challenges, including as the availability of charging stations and the integration of such facilities with the current power system.[14]15][16][17] [18]The effects of the charging stations on the utility system, problems with the quality of the power, and similar factors present another set of difficulties.

In the last decade or two, the hybrid electric car has been proposed as a solution. However, the control strategies to divide the power between the IC engine and the energy storage system proved difficult, making the optimization of power splitting between the grid and the ESS a promising study topic [3]. Additionally, the tactics for speed control over broad speed ranges for various motor types and driving cycles of the drive train are being studied. According to the literature, there are four main areas of study for electric vehicles. The surroundings are what they are (drive cycle) [21] [22].

2. METHODOLOGY

Section I - The Value of the Driving Cycle When starting, the motor's design may deliver high starting torque at low speeds and high road-grade performance on highway and urban drive cycles. As a result, wide speed operations are needed, which places a demand on motors to deliver high speeds with constant torque and high torque with continuous power. Due to the weather and road conditions, the traction motors must also withstand high temperatures and harsh vibrations. Validating the characteristics of the motor chosen for the vehicle requires a thorough examination of the driving cycle of any city or region, which includes various operating circumstances including idle, acceleration/deceleration, and cruising. The driving cycle is a representation of how a vehicle actually operates [4]. This makes it crucial for the design of transportation-related motors. To comprehend the significance of drive cycles and their function in vehicle design, studies have been done. To help with the EV's strong architecture, a brand-new drive cycle based on

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discrete cosine transforms was introduced. In [5], it is examined how the drive cycle affects HEVs employing induction motors. Some academics consider EV drives to be industrial drives under Section II- Motor Design and its Control. However, EV drives typically need a very wide speed range of operation, frequent starting and stopping, rapid acceleration and deceleration, high torque and low speed during hill climbing, and low torque and high speed for cruising. [6][7] Like any other motor drive, the EV needs to have a high power density and good efficiency. They also need strong controllability, strong dynamic performance, and strong steady state accuracy [8]. They must be deployed in mobile trucks operating in challenging environments from an installation perspective. It's crucial to choose the right motor rating for an electric car. The effectiveness, dependability, and cost of the motors are the primary determinants. Any motor's performance may vary depending on the operating circumstances. The drive cycle of a vehicle is a representation of its motor performance while driving over urban and suburban terrain. As a result, the motor's study must be based on its dynamic properties. [7] The rotor resistance determines the motor torque; a slight variation in the rotor resistance has no impact on the motor's dynamic performance. The motor's early oscillations are minimized as rotor resistance rises. The current drawn from the supply was too high and the transients continue for a very long time due to the rise in stator inductance. As a result, the motor operates satisfactorily when its mechanical parameters, such as its resistance and inductance, are kept as low as feasible [8].

3.RESULTS:

.DC motors, Induction motors, PMSMs, SRMs, and BLDC motors are among the motors that are frequently thought of for use in transportation. Based on the simulation performed on the ADVISOR platform, the main factors for choosing an appropriate motor for an electric vehicle are reviewed, and a comparison between IM and PMSM is offered [10].

It has been claimed that the torque speed profile of induction machines must produce 1.5 to 2.5 times the rated speed for traditional designs beyond the breakdown torque limitations and the constant power region. The machine power rating needs to be increased twice in order to achieve four times the rated speed in the field weakening zone at the rated power[9]. The limits of the DC motor and the induction motor with regard to their appropriateness for EVs were explored, and a design based on the SRM was presented. The appropriateness of SRM for a broad range of tasks is explored, along with how simple it is to analyze the same using computer models [11]. Two series-parallel HEV systems have been compared, together with their control schemes and modes of operation. The Energetic Macroscopic Representation (EMR) and an inversion-based control approach are the study's foundations [12]. The motor control is covered in full in [2][3][4], along with the various traditional and intelligent speed estimation algorithms. Analytical motor component optimization has been done, and validation is based on FEA (Finite Element Analysis) results [14].

Vector control is frequently used in traction, however contemporary predictive approaches with online optimization algorithms are suggested as a replacement. Future predictions indicate that the PM Syn RM and PMS RM will predominate [15]. For both scalar control (V/f) and vector control (FOC) of an inverter fed induction motor, the regeneration control approach is explored. The current and power flow for all driving ranges is used to explain and confirm the mode shift from motoring to generating [13]. Induction motors used in electric buses have a speed and flux control without the usage of sensors. The suggested control led to softer inverter switching, a lower dv/dt, no voltage surges, ripple-free dc current from the battery, and longer battery and motor lifetimes. The method was put to the test and produced positive outcomes [15]. A predictive torque control is suggested as a way to achieve the best performance out of the electric vehicle using complex management (Liu et al., 2004). PWM control is typically used for DC motors, while induction motors use direct torque control (DTC), field-oriented control (FOC), and variable voltage variable frequency (VVVF). Modern high-performance control technologies, such as adaptive control, fuzzy control, artificial neural network, and expert systems are used because a simple PID controller cannot meet the needs of the vehicle [19][20].

4.CONCLUSION

Every element has the potential for research, according to the literature review. Studies on the penetration of EVs and their effects on the grid are being co nducted as a result of the growing concern over emissions.Since IM is still utilized due to its durability even if newer designs of the SRM and PMSM have demonstrated to be more suitable for EV, motor design and control proves to be a prospective field. The potential for study in this area is growing as a res ult of the rise in power electronic gadgets. The ESS is a fertile topic for research since it necessitates effective power management.[13] [14] 15] [16] [17] [18] .

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