Dual-Propulse Motor Electric Vehicle Driver Pro-E Design

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Abstract

This paper mainly introduces the overall design of the electric vehicle. Based on the research of the traditional electric vehicle, the design scheme of the electric vehicle with double front motor is determined. Reasonable choice of the parameters of the design of the electric vehicle, through the calculation of a reasonable choice of motor, reducer and batteries and other devices, so that the device can meet the needs of electric vehicles. In the las t part of the paper, the selected parameters are checked to verify the rationality of the design of the electric vehicle.

Keywords

Double precursor electrombile; vehcle speed reducer; check.

1. Introduction

The content of this design is the overall design of the dual-precursor motor electric vehicle. Two electric motors are used to independently drive the two front wheels of the electric vehicle. Power is provided by the battery, and the deceleration and torque increase of the motor are achieved through the speed reducer.[1] In the design of this topic, first of all, through the choice of parameters, the rational selection of the motor, reducer, battery and other devices is performed. In order to achieve the differential when turning the designed electric vehicle, this subject adopts the principle of dual-motor electronic differential system to ensure the stability of the vehicle when the electric vehicle turns. Finally, the selected parameters are checked to ensure the rationality of the design of the dual-motor electric vehicle.

2. Overall Structure of Electric Vehicle Design

The vehicle adopts a motor front-front-front-wheel drive to provide power.[2] Such a design can achieve a reasonable distribution of loads and the stability of driving operations. The overall block diagram of the dual-precursor motor electric vehicle designed as shown in Figure 2.1

The structure of the dual-precursor motor electric vehicle is a drive control system, a body, an electrical system, a battery system, and a chassis.

The drive control system is a very important part of the electric vehicle.[3] Its role is to pass the energy of the battery to the motor and rotate the motor under the driver's control to realize the operation of the electric vehicle. The drive control system is mainly composed of a motor, a decelerator and a motor controller. The battery and the motor are connected and adjusted through a motor controller. The motor and the decelerator are connected through a shaft to constitute a power output device of the vehicle.

As the energy output source of electric vehicles, the battery system's main function is to provide power for the drive system. The power battery is also a very important part of the electric vehicle design process. The number of charge and discharge of the battery, the size of the battery, and the size of the load must all be considered one by one. Nowadays, when the motor is selected, a brushless DC motor is generally used.

The main role of the chassis is to support the weight of the vehicle, and the power output by the motor is transmitted to the drive wheels through the speed reducer. In addition, the vibration of the vehicle and the forces and moments transmitted by the vehicle when traveling under different road conditions are also reduced. Improve the comfort of the vehicle.

The electrical system is also an important part of an electric vehicle. It consists of high and low voltage electrical systems. The motor controller accepts the battery output power to drive the motor to rotate and provide power to other systems, which is a function in high voltage electrical systems. The role of the low-voltage system is that the high voltage of the battery can be converted to the voltage required by the electric vehicle instrument through the voltage converter, providing power for the vehicle dashboard, other power systems, and charging the battery for auxiliary functions.

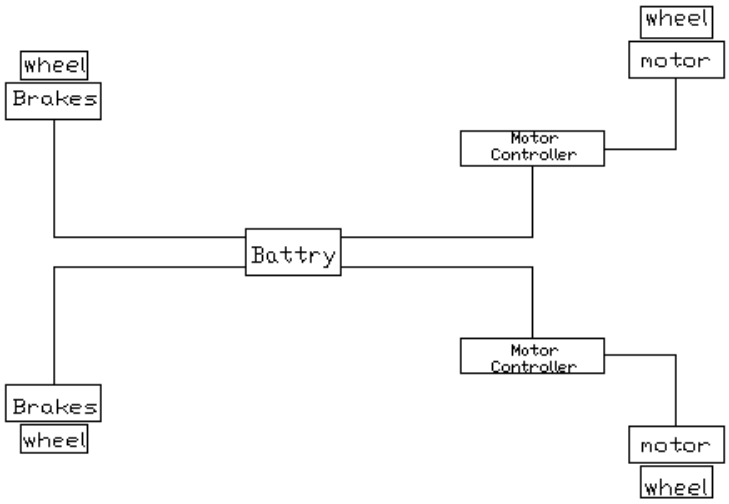

Figure 1. Structure diagram of dual front drive motor vehicles

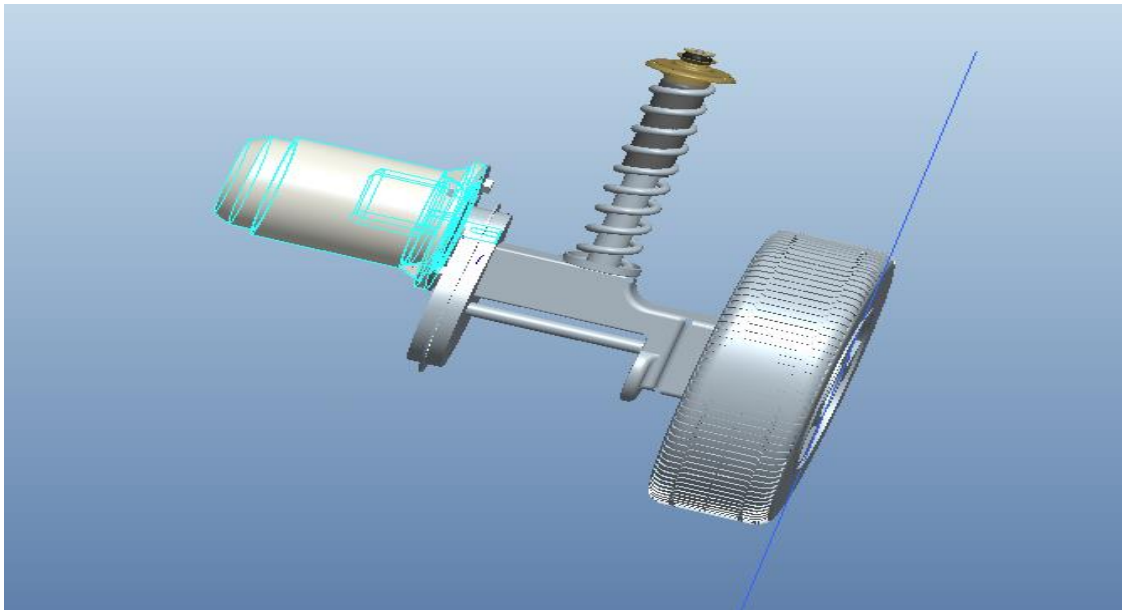

Figure 2. Double front motor electric vehicle front structure

3. Selection of Vehicle Parameters

The speed and torque of the motor under certain conditions correspond to its efficiency. Due to the limited energy of the battery in the electric vehicle, when matching with the motor power, the power effect of the motor in actual operation should be ensured as much as possible so that the motor always maintains high-efficiency rotation [4].

The choice of motor power should be to make the vehicle at a certain speed, but also according to the vehicle's operating conditions, long-term full-load work, must reach the maximum speed of electric vehicles, electric vehicles can travel at the maximum speed of the flat road. To select the right motor, we must first understand the electric power demand of electric vehicles. The following is the calculation formula of the motor power that we need. We have budgeted the total weight of the car, and we will conduct the research later.

$$P_u = \frac{1}{\eta_T}\left(\frac{Gf}{3600}\mathrm{u}_{\mathrm{amax}} + \frac{C_D A}{76140}\mathrm{u}_{\mathrm{amax}}^3\right) \tag{1}$$

$\mathrm{u}_{a\max}$: The maximum speed of the vehicle;

G : The total weight of the car;

f : The coefficient of running resistance of a car on a good road surface (take 0.015);

C_D : Air resistance coefficient (0.5 is taken here)

A : car upwind area;

Because the designed vehicle's overall vehicle mass is 1300kg, that is 12740N.

The maximum speed design requirement is 60km/h.

Windward area = vehicle width × height, vehicle width tentatively set at 1770mm, and vehicle height 1460mm tentatively set

There is an area of A=2.6 m^2

The value substitution formula will have a (3-1) calculation:

$\mathrm{p}_u = 8.2\mathrm{kw}$

When the car reaches the maximum speed of 60km/h and the wheel rotation radius is 0.26m, the rotation speed of the wheel is

$$n = \frac{60\times10^3}{60\times2\pi\times0.26} = 636rpm \tag{2}$$

The maximum climbing rate of the designed electric vehicle is 15%. The required unilateral wheel torque is:

$$T = \frac{1}{2}mgr\left(f\cos\delta + \sin\delta\right) = 145N\cdot m \tag{3}$$

According to the above calculation data, according to the selection principle of the motor, the selected model of the electric vehicle motor is: ISG9 permanent magnet synchronous motor, base speed is 1400rpm, maximum speed is 2000rpm, rated torque is 75Nm, rated power is 9kW, rated voltage is 48V.

4. Conclsion

As an environmentally friendly vehicle, electric vehicles need to continuously improve the electric vehicle program in order to better meet people's requirements for safety and comfort. After gaining knowledge of electric vehicles through various means, the internal assembly and internal structure of the dual-precursor electric vehicle were selected and related equipment was selected. After that, the selected results were verified to see if they meet the requirements of the electric vehicle program.

References

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