Based on SIMULINK to a Single Set of Battery Load Isolation Pure Electric Driving Modeling and Simulation

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Abstract

Load isolation pure electric driving increased the range of electric vehicles, to distinguish the concept of power and energy, let the engine can work in the most economical condition area.In this paper, a mini car based on SIMULINK is established on the basis of a single set of batteries load isolation pure electric driving vehicle model.According to performance index, matching the system model of the vehicle, gasoline generating set, the parameters of the battery and motor model.From average speed up to set the highest speed in the process of analysis to get the battery voltage curve and the motor output power, the result is shown in the battery more than dangerous voltage, the motor does not exceed peak power, the simulation results verify the feasibility and superiority of the model.

Keywords

Load isolation pure; Parameters matching; Model; The simulation.

1. Introduction

Facing serious environmental problems,the development of electric vehicle industry has become a trend of the development of automobile technology[1].Pure electric vehicles abandoned the traditional car's complex mechanical structure,the battery is the energy storage device to provide power for the car, the motor as the driving device,with a simple structure, zero emissions, low noise,etc [2].

In this paper,Matlab/Simulink to build a load isolation type electric vehicle based on the model,because the number of battery has little influence on the modeling and simulation,in order to simplify the model,only the establishment of a single battery load isolation type electric car model of vehicle's dynamic system and the main components of the parameter matching and simulation the vehicle performance [3,4].

2. Build body model

Vehicle longitudinal dynamic model of load isolation type electric vehicle model first need to build a vehicle, then the model is encapsulated into the vehicle longitudinal dynamics subsystem, parameter setting according to the requirement of the model, the Zhejiang Geely Holding Group Company Limited is the production of Geely panda cars, the initial vertical speed is set to 0.1m/s[5].

3. Parameter matching and model building of single battery

The high energy density of battery electric vehicle is the key to reach the target mileage,high power density can make electric cars in the driving process has better driving power regulation function, integrated management system and thermal management system shows the battery level of SOC and temperature can be real-time,long battery life. Referring to the above factors and the current domestic and foreign manufacturers of electric vehicle battery usage,as well as the existing equipment and safety considerations, the model selection of lithium iron phosphate battery[6].

It is assumed that the model takes the average 43km/h of the vehicle speed, and the output of the motor is the power of the motor:

$$P_{ave} = \frac{1}{\eta_t}\left(\frac{Mgf}{3600}u_{ave} + \frac{C_D A}{76140}u_{ave}^3\right)$$

The prototype parameters into the formula, Pave=2.14kw; Pbat-ave=2.37kw; Cp≥ 28.61Ah, here take K to the value 1, Cp=30Ah.Model is in accordance with the average speed and the average power of the battery, in order to ensure the power and charge and discharge requirements, the load isolated electric vehicles selected a more suitable 82V, 100AH lithium iron phosphate battery. The single battery is 100Ah, 82V, internal resistance of single cell 30mΩ, so the battery internal resistance of 30mΩ*23/10=69mΩ=0.069Ω.

4. Engine and generator parameters matching

The output power of the generator is the factor which needs to be considered first. When the electric quantity reaches the alarm level, the generator will need to work to meet the steady state running power of the electric vehicle. The engine and the load are completely isolated, only as an energy conversion device, in a timely manner to provide power for the battery. With the continuous development of battery technology, the future of the fast charging technology will be more and more perfect, so the model select the average speed and the average power as the reference index to select the engine. On the basis of the average index can greatly reduce the size and power of engine, reduce weight, and improve the economic efficiency of electric vehicles [7].

5. Motor parameter matching and model simulation

Motor has a long history of development, motor technology has been very mature. At present, there are many kinds of motor used in motor vehicles, among which the most widely used in induction motor, DC motor, AC motor and switched reluctance motor is the most widely used. The digital scoring algorithm is used to compare the performance of the four kinds of clicks, and the comprehensive factors, the model selection of small power AC induction motor as the load isolated electric vehicle drive motor. According to the battery power parameters, as well as the motor power rating of the relevant provisions of the model selection of rated power of 10kW, peak power of 16kw low speed motor.

The model eliminates the transmission system, so io=1.According to set the maximum speed 75km/h to determine the maximum speed of the motor is 3979rpm,n=4500rpm, the motor to expand the constant power area coefficient of 2.5, so the rated speed of the drive motor is 1800rpm. Rated torque of motor is 53.05Nm.

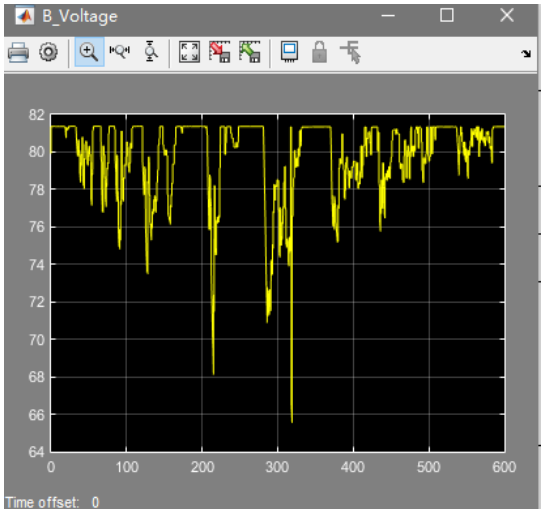

Fig.1 voltage variation curve of battery pack

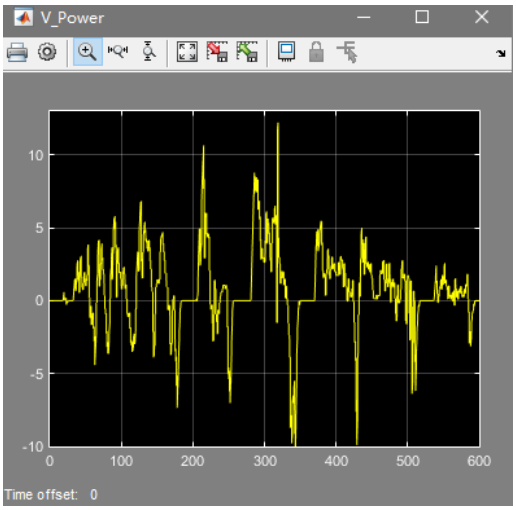

Fig.2 motor output power curve

6. Simulation result analysis

The model is connected with a oscilloscope module output speed in the speed output port, simulation model of electric vehicle acceleration from the average speed of 43km/h to 75km/h, observe the battery voltage curve as shown in Figure 1 the existence of overpressure danger, and the output power of the electric motor as shown in Figure 2 is it dangerous to exceed the peak power. The results show that there is no danger of the battery and the motor power is not beyond the peak power, the model is in line with the requirements.

7. Conclusion

Through the Matlab/simulink software to model and Simulation of the load isolation type electric vehicle, the simulation results meet the expected effect of the vehicle, and verify the feasibility of the load isolated electric vehicle. The model selection of the motor and gasoline generator model is slightly larger, so the future can be optimized for these components, the effect will be better [8].Through the analysis of simulation results and experimental data provides a theoretical basis for the optimum design and the load of two or more groups of cell isolation type electric vehicle modeling and simulation, has very important guiding significance.

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