



Design of Pure Electric Vehicle Training Platform and Development of Fault Diagnosis System

Yongan Zhang, Dong Guo

Shandong University of Technology, Zibo 255000, Shandong, China

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Abstract: The main purpose of the researched pure electric vehicle fault diagnosis system is to be used for electric vehicle fault diagnosis and maintenance. The experimental bench integrates pure electric vehicle fault diagnosis and fault point setting. With more advanced fault diagnosis algorithms, it can not only solve the limitations of pure electric vehicles such as untimely diagnosis of hidden faults, slow fault diagnosis, and low diagnosis accuracy, but also improve the efficiency of fault diagnosis and processing of electric vehicles.

Keywords: pure electric vehicle, troubleshooting efficiency

1. Analysis of common faults of electric vehicles

Electric vehicle failure refers to the special situation that the electric vehicle lacks the power of the vehicle or some functions cannot operate normally due to some reasons, which usually occurs during the operation of the vehicle. The common faults of electric vehicles are generally divided into three categories: one is functional faults, such as the car's accelerator does not respond or brakes fail; the other is warning fault symptoms, such as the vehicle power battery is low, tire pressure is not at normal values; the last category is check fault symptoms, also known as hidden fault symptoms, such as inconsistent tire pressure — this type of fault is the most difficult to find. The failure of electric vehicles is usually caused by factors such as improper driver operation, improper maintenance, and poor driving conditions. The occurrence of electric vehicle failures will greatly affect the safety and economy of driving. It increases and decreases, so it is particularly important to analyze the failure of electric vehicles.

2. Reasons for the failure

There are many reasons for the failure of electric vehicles, including the vehicle's own factors and human factors, which can usually be divided into the following points:

(1) Influence of vehicle use environment. When the vehicle is running in a harsh environment, such as the sun exposure in summer, the parts on the car will be deformed or loosened, the erosion of rain and snow will cause the metal parts to rust, and the cold in winter will cause Reducing the life of the power battery or the false standard of power, etc. will affect the safe driving of the vehicle and cause failures.

(2) Influence of the vehicle driver. Electric vehicle is a complex machine with high technical integration. For drivers who are not skilled in driving or unfamiliar with vehicle conditions, the vehicle may malfunction due to improper operation when driving the vehicle. This is also the most common failure cause of electric vehicles, and the direct cause of electric vehicle failures.

(3) Influence of vehicle parts. As we all know, vehicles are composed of tens of thousands of parts. When the vehicle is designed and produced, the materials used in different parts of the vehicle are also different. The manufacturers of the parts are also different, and different manufacturing processes will also cause differences in the life of the parts, so there will be conflicts at the connections of different parts, resulting in vehicle failures.

(4) The impact of vehicle maintenance product quality. The normal operation of electric vehicles is inseparable from the normal maintenance of the vehicle, but if inferior maintenance consumables are used during vehicle maintenance, such as inferior lubricating oil, inferior charging guns or charging piles, they will all be damaged. It will have a certain impact on electric vehicles, causing serious consequences such as car paralysis, reduced battery life, and failure of the car to start normally.

3. Common types of failures

There are many kinds of faults in electric vehicles. Once the vehicle fails, it will bring heavy workload to researchers or maintenance personnel. In the process of fault diagnosis, if the maintenance personnel misjudge or miss the fault due to lack

of experience, they will often make mistakes in electric vehicles. The impact is not conducive to the healthy and long-term development of the automotive diagnostic industry. Therefore, it is particularly important to summarize and correctly judge the fault types of electric vehicles to maintain the development of the industry. The common faults of electric vehicles are mainly divided into the following categories:

3.1 Controller failure

Electric vehicles are composed of multiple controllers, including vehicle controller VCU, CAN bus network and word system controller ECU. Among them, the CAN bus network is responsible for the reception and transmission of data. When the data of the electric vehicle cannot be read normally or cannot be received and sent, it is very likely that the CAN bus network of the electric vehicle has failed; according to the strategy set by the vehicle controller, the ECU of each subsystem will send data information to the vehicle controller VCU according to a certain period, and the vehicle controller will also send the control strategy to the subsystem controller according to the data information. response, it is very likely that the controller of the subsystem has failed.

3.2 Sensor failure

Each electrical system of an electric vehicle has its own different sensors to collect and receive signals from different positions of the vehicle, and send the collected information to the controller responsible for the system, and finally collect it to the vehicle controller through the CAN bus network. If the sensor itself fails, there will be a certain deviation in the collected data signal, or even the data signal cannot be collected. At this time, the data uploaded to the vehicle controller will be blank information or error information, and the vehicle failure judgment cannot be completed. .

3.3 Actuator failure

The instructions issued by the controller in the electric vehicle need to be executed by the actuator, which plays an extremely important role in the electric vehicle system, but is prone to failure. Because the actuator has a complex structure, a wide variety of types, and various faults, it is extremely important to diagnose the working state of the actuator in real time and ensure the normal operation of the actuator to ensure the normal operation of the electric vehicle.

In addition, the faults of electric vehicles also include abnormal vehicle performance, abnormal vehicle operating conditions, abnormal vehicle exhaust smoke color, vehicle leakage, vehicle overheating, abnormal vehicle appearance, abnormal vehicle driving, vehicle odor, abnormal vehicle noise, etc. The above faults They are all caused by abnormal circuits, damaged parts or reaching the service life, and system collapse, which will have a great impact on the normal operation and safe driving of electric vehicles.

Therefore, when electric vehicle failures are found, they should be dealt with in a timely manner, so as to prevent problems before they occur, and ensure the regular maintenance and overhaul of the vehicle, so as to ensure that the vehicle can reach the maximum service life and improve the driving safety and comfort of the driver.

4. Electric vehicle fault classification

The faults of electric vehicles have different manifestations. A reasonable classification and summary of the faults of electric vehicles will help the maintenance and inspection personnel to diagnose the faults of electric vehicles more accurately, which has achieved the best maintenance effect. The common fault classification of electric vehicles is as follows :

(1) According to the form of fault symptoms, it can be divided into dominant fault symptoms and recessive fault symptoms. The dominant fault symptom refers to the fault that the driver can discover in time when the fault occurs; the recessive fault symptom refers to the fault that actually exists, but the driver is not easy to find when the fault occurs, and can only be diagnosed by a specific fault detector.

(2) According to the consequences of failures, it can be divided into general failures, serious failures and fatal failures. General failure refers to the failure of some parts of the car; serious failure refers to the overall failure of the car that cannot be dealt with in time while driving; fatal failure refers to the failure that causes serious damage to the car and affects the normal driving of the car.

(3) According to the failure time, it can be divided into running-in failure, normal use failure and wear-out failure; according to the development process of failure, it can be divided into sudden failure and progressive failure; according to the existence time of failure, it can be divided into intermittent failure and continuous failure Sexual failure. Intermittent failure means that some parts or functions of the vehicle sometimes fail; persistent failure refers to irreversible damage to certain parts or functions of the vehicle, which must be repaired or replaced to return to normal.

(4) According to the location of the fault, it can be divided into partial fault and overall fault. Partial failure is manifested

in the failure of one or more functions of the car, which only affects the corresponding parts of the failure; the overall failure is manifested in the failure of one or more functions of the car, and the entire car cannot operate normally.

(5) According to the causes of failures, it can be divided into natural failures and man-made failures. Natural failure refers to the failure of the car during normal driving or the failure of some components in the car due to potential hidden dangers in the production process; the human factor refers to the failure caused by improper operation of the driver or human damage.

(6) According to the failure of the system can be divided into single-system failure and multi-system failure. Single system failure refers to the failure of a certain system of the vehicle, which only affects the normal operation of the system; multi-system failure refers to the simultaneous failure of multiple systems of the vehicle, which has a greater impact on the vehicle.

In addition, it can be divided into functional faults, warning faults and concealed faults according to the characteristics of faults; according to the causes of faults, it can be divided into design faults, manufacturing faults, use faults and maintenance faults; according to the form of faults, it can be divided into functional faults and parameter faults. By classifying vehicle faults, it is helpful for maintenance personnel or relevant scientific researchers to locate the cause and location of the fault more quickly and accurately, so that the fault can be dealt with in time.

5. Fault diagnosis and control mechanism of pure electric vehicle

During fault diagnosis of pure electric vehicles, it is often necessary to transmit the fault information of the vehicle to the vehicle controller through hard wires or CAN bus for safe processing, and to judge the status of each sub-control unit and the vehicle system, so as to make the driver or maintenance personnel can quickly find faults and make corresponding judgments, so the vehicle controller is particularly important in the fault diagnosis of pure electric vehicles. The working principle of the vehicle controller mainly includes signal acquisition module, functional logic module, power supply module and signal processing module. Its main functions are: power-on and power-off, working condition judgment, drive control, energy recovery, energy management, vehicle information management, fault diagnosis and control, accessory function management, and charging management. The normal and safe driving of electric vehicles is inseparable from the synergy of controllers such as normal controllers, motor controllers, battery management systems, DC/DC controllers, and high-voltage control units. When one of the controllers fails, it will affect the normal operation of the vehicle. Therefore, the vehicle controller, as the core control unit to ensure the operation of the vehicle, is responsible for the diagnosis and management of vehicle faults, evaluates various faults occurring in the vehicle, and makes relevant instructions according to the risk factor of the fault to ensure that the vehicle and the safety of occupants in the vehicle. First, the fault diagnosis enable assignment needs to be performed according to the vehicle design requirements. If the assignment result is true, the fault diagnosis is performed. After the fault diagnosis, it is necessary to further troubleshoot the fault type, and obtain the corresponding fault state according to the diagnosis result, and then store the core fault according to the fault diagnosis requirements. The fault information obtained from the diagnosis can be displayed through professional fault diagnosis equipment or the instrument of the vehicle cab.

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