ISSN: 2394-3696, Website: www.ijiert.org, Organized on 24-25 April, 2020

PECULIARITIES OF SELF-DIAGNOSTICS OF MECHATRONIC SYSTEMS OF ENGINES AND TRANSMISSIONS OF CARS

Umerov Fikret Shevket oglu, Tashkent State Technical University, Senior Lecturer, Tashkent, Uzbekistan

Annotation. On the example of a mechatronic engine and automobile control system, the technology features of their self-diagnosis are shown.
Key words: automobile, mechatronics, diagnostics, research methods, construction principles.
Аннотация. На примере мехатронной системы управления двигателем и автомобиллем показаны особенности технологии их самодиагностирования.
Ключевые слова: автомобиль, мехатроника, диагностика, методы исследования, принципы построения.

Mechatronics arose as a complex science from the merger of individual parts of mechanics and microelectronics. It can be defined as a science engaged in the analysis and synthesis of complex systems in which mechanical and electronic control devices are equally used.

The mechatronic engine control system basically has integrated torque control of the power unit, that is, the torque is regulated for one of the possible engine operation modes: engine start mode; engine warming up; idling; riding under load; transient modes; engine braking; inclusion of additional equipment, etc. The computer affects the engine torque by adjusting the air supply, as well as by adjusting the UOZ (ignition timing).

All mechatronic systems of vehicles for functional purpose are divided into three main groups [1]:

- engine management systems;
- transmission and chassis control systems;
- interior equipment control systems. The engine management system is divided into gasoline and diesel engine control systems.

By appointment, they are monofunctional and complex.

In monofunctional systems, the ECU only signals the injection system. Injection can be carried out continuously and pulses. With a constant supply of fuel, its amount changes due to a change in pressure in the fuel wire, and with a pulse, due to the duration of the pulse and its frequency.

In complex systems, one electronic unit controls several subsystems: fuel injection, ignition, valve timing, self-diagnosis, etc.

Interior equipment management is designed to increase the comfort and consumer value of the car. For this purpose, an air conditioner, an electronic instrument panel, a multifunctional information system, a compass, headlights, a wiper with intermittent operation, an indicator of burned out lamps, an obstacle detection device when reversing, anti-theft devices, communication equipment , central locking of door locks, power windows, are used seats with a variable position, safety mode, etc.

Management of the chassis includes the management of the processes of movement, changing the trajectory and braking of the car. They act on the suspension, steering and braking system, ensure the maintenance of a given speed.

Interior equipment management is designed to increase the comfort and consumer value of the car. For this purpose, an air conditioner, an electronic instrument panel, a multifunctional information system, a compass, headlights, a wiper with intermittent operation, an indicator of burned out lamps, an obstacle detection device when reversing, anti-theft devices, communication equipment, central locking of door locks, power windows, are used seats with a variable position, safety mode, etc.

The decisive importance that belongs to the electronic system in the car makes us pay more attention to the problems associated with their maintenance. The solution to these problems is to include self-diagnosis functions in the electronic system. The implementation of these functions is based on the capabilities of electronic systems that are already used on the vehicle for continuous monitoring and troubleshooting in order to store this information and diagnose it. The internal combustion engine control system is an electronic control unit (ECU) that receives data from various sensors. The continuous supply of information to the engine control unit allows the ECU to control and dynamically adjust the operation parameters of various ICE systems and mechanisms.

In fig. 1 shows an example of a mechatronic control circuit of an internal combustion engine of a car [1].

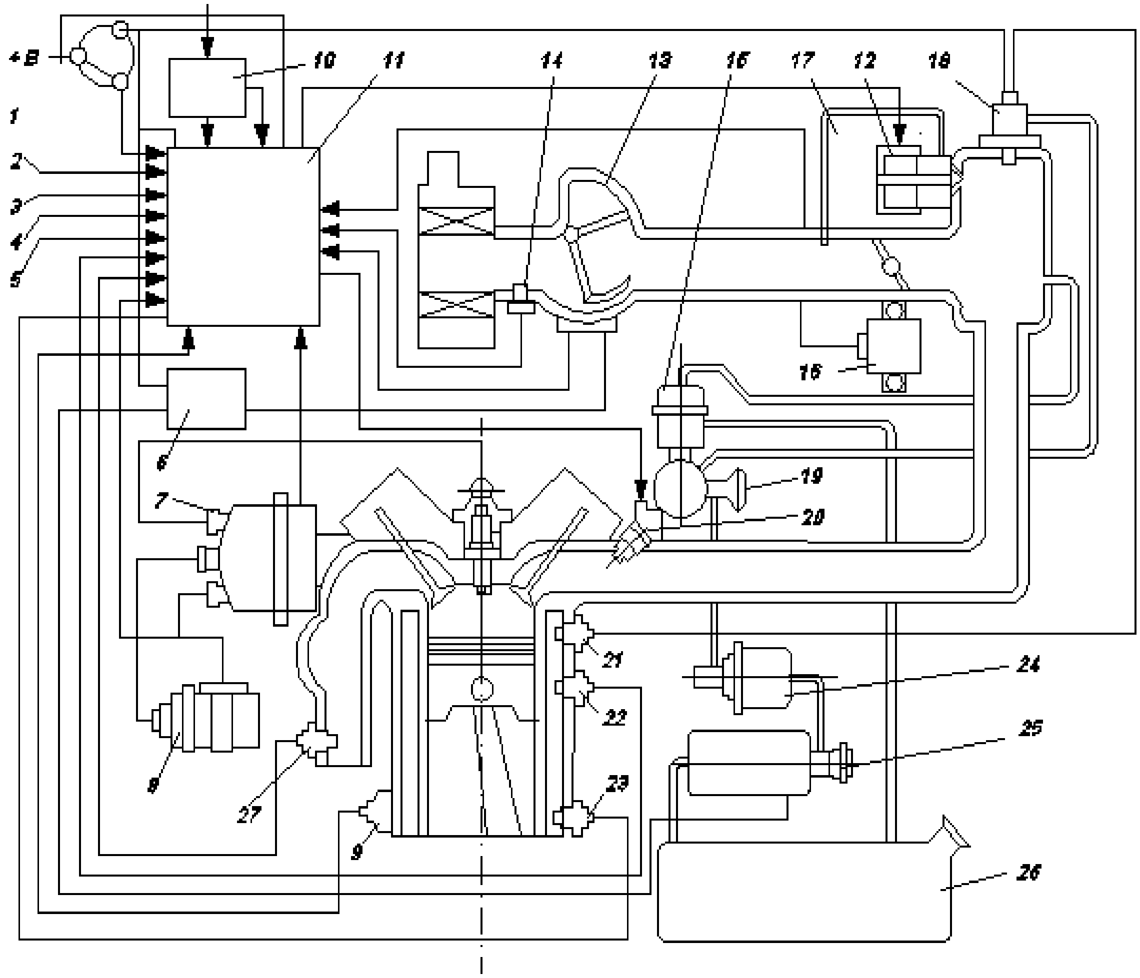


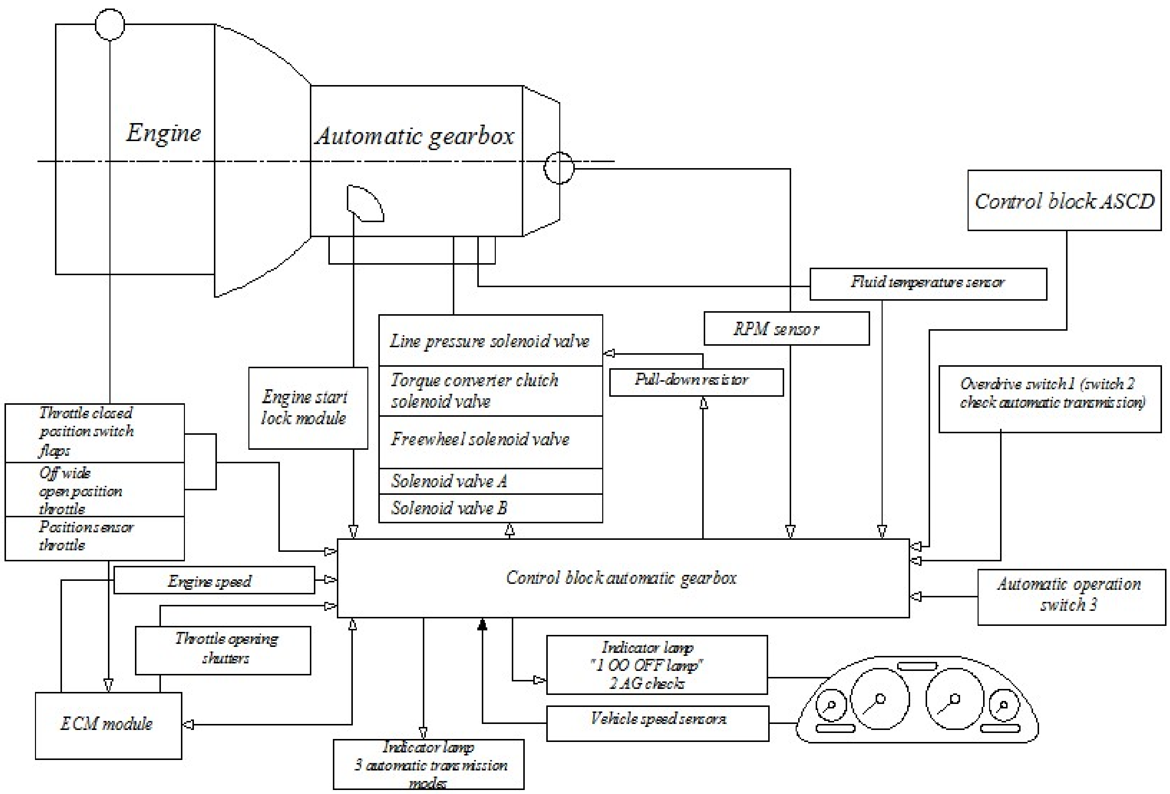
Fig. 1 .: 1- ignition key; 2- diagnostic connector; 3- neutral gear signal; 4- signal for turning on the air conditioner; 5- vehicle speed signal; 6- power relay; 7- distributor of ignition; 8- ignition coil; 9- emergency oil pressure drop sensor; 10-relay; 11- electronic control unit; 12-step engine idle crankshaft control system; 13 - air flow sensor; 14 - temperature sensor of air entering the engine; 15- pressure regulator; 16- throttle opening angle sensor; 17- idle valve; 18- nozzle of cold start; 19- pressure reducing valve; 20-nozzle; 21- heating timer; 22- coolant temperature sensor; 23 - knock sensor; 24- fuel filter; 25- fuel pump; 26- tank for fuel; 27- oxygen sensor.

ISSN: 2394-3696, Website: www.ijiert.org, Organized on 24-25 April, 2020

The development of electronic engine and transmission control systems has led to improved operational properties of the car.

Mechatronic transmission control is as follows. Based on the sensor signals, the computer generates commands for engaging and disengaging the clutch. These commands are given to the electromagnetic valve, which enables and disables the clutch actuator. Two or more solenoid valves are used to shift gears. By combining the open-closed states of these two valves, the hydraulic system sets six gear positions (1, 2, 3, 4, 5 and upshift). When shifting gears, the clutch disengages, thereby eliminating the consequences of changing the moment associated with the gear shift.

In fig. 2 shows an example of a mechatronic vehicle transmission control system [2].



The laws of control (program) of gear shifting in automatic transmission ensure optimal transmission of engine energy to the wheels of the car, taking into account the required traction and speed properties and fuel economy. At the same time, programs to achieve optimal traction and speed properties and minimum fuel consumption differ from each other, since the simultaneous achievement of these goals is not always possible.Therefore, depending on the driving conditions and the desire of the driver, you can select the "economy" program with the help of a special switch to reduce fuel consumption, the power program - to improve traction and speed properties or the "manual" program to switch the driver to gear changes.

The electronic control unit (ECU) performs a self-test of its operation as follows: the programmable memory chips are equipped with test combinations that can be restored and used for comparison purposes. For storage devices, a comparison with the final test data is used to ensure that all data and programs are stored in these devices correctly.

Self-diagnosis capabilities include: system identification and ECU; recognition, storage and reading of information about static and single violations of work; reading current real data, including environmental conditions and specifications; modeling system functions; programming system parameters.

Separate programs for the test unit are stored in plug-ins, while adjustments and data transfers in the system are done through the data interface.

In fig. 3 is a structural diagram of the self-diagnosis of mechatronic systems of cars [4].

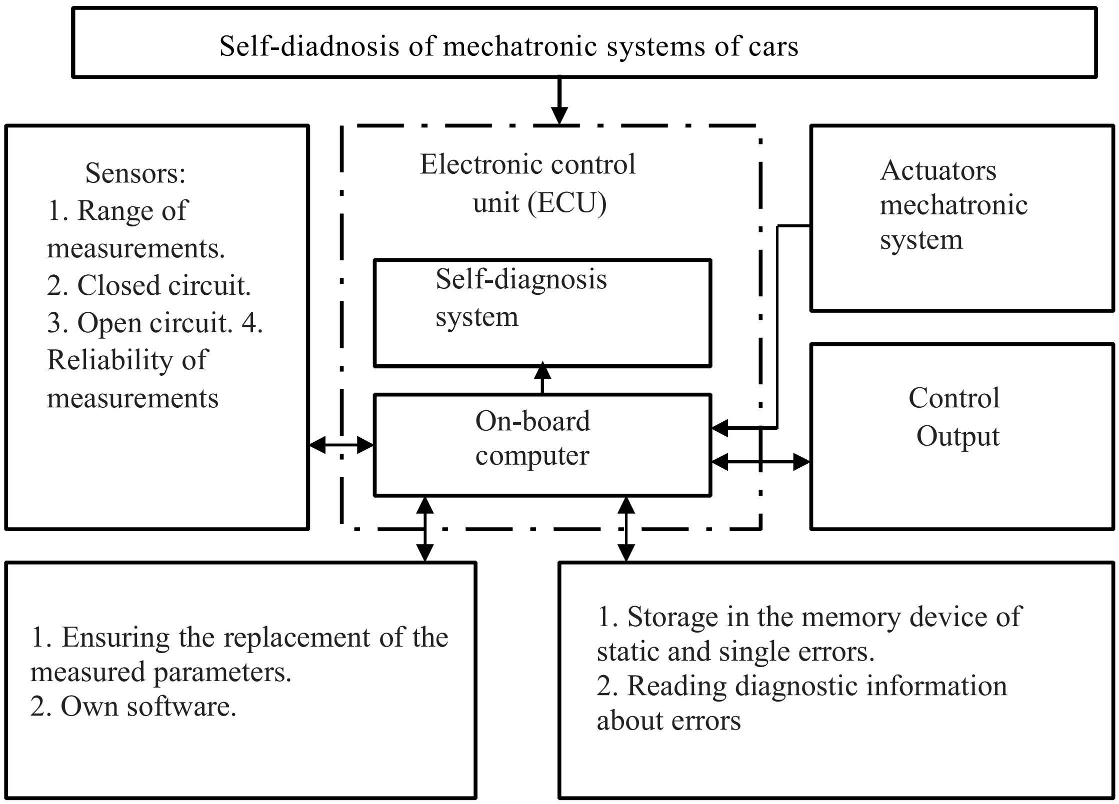


Fig. 3. The structural diagram of the self-diagnosis of mechatronic systems of cars

The diagnostic process begins with the initialization of the systems - their detection as part of the electrical equipment of the car. With successful initialization, it is possible: to read the error memory; erase error memory; view the data of the next detected system or go to the main menu; change the readings of the selected discharge; Correct the current time; Correct the current date and perform a number of additional functions.

Self-diagnosis is standard for all microprocessor control systems. During normal operation, self-test functions are provided in parallel with other functions, such as fuel injection and ignition; suspension control; ABS / PBS operation, etc. Self-diagnosis is characterized by the fulfillment of several requirements: monitoring the operation of complex systems and nodes. The increasingly complex engine design makes self-diagnosis capabilities very important for troubleshooting. The goal is to integrate the entire system into the diagnostic process.

The diagnostic program allows you to obtain information about current system malfunctions (active malfunctions), if any, as well as information about malfunctions that were, but are not currently available (passive malfunctions). In addition, information can be obtained on the number of the electronic unit, its manufacturer and date of manufacture, software version, date of the last change in parameters. From the electronic block of the engine management system data can be read about the total operating time of the engine, including idling, total mileage of the car, mileage after the last maintenance.

List of references

1. Kadyrov S.M., Umerov F.Sh. Mechatronics. Performance indicators of cars. Monograph. - T., 2019 .-- 95 s. /WITH. 51-53.
2. Butylin V.G., Ivanov V.G., Lepeshko I.I. et al. Analysis and development prospects of mechatronic control systems for wheel braking // Mechatronics. Mechanics. Automation. Electronics. Computer science. - 2000. - No. 2. - S. 33 - 38.
3. Danov B.A., Titov E.I. Electronic equipment of foreign cars: Transmission, suspension and brake control systems. - M.: Transport, 1998 .-- 78 p.
4. Danov B. A. Electronic control systems of foreign cars. - M .: Hot line - Telecom, 2002 .-- 224 p.
5. http: //krutimotor.ru/benzinovyj/ustrojstvo/sistema-elektronnogo-upravleniya/