METHOD OF EXPERIMENTAL RESEARCH INTRODUCTION OF A MULTI-LEVEL ESU DIAGNOSTIC SYSTEM SELF-PROPELLED NARROW-GAUGE POWER STATION

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СПОСОБ ЭКСПЕРИМЕНТАЛЬНОГО ИССЛЕДОВАНИЯ ВНЕДРЕНИЯ МНОГОУРОВНЕВОЙ СИСТЕМЫ ДИАГНОСТИКИ ЭБУ

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ABSTRACT

In this article, the achievement of the set goal is discussed, and the results of the experiment are used to test theoretical developments and substantiate diagnostic effects on the control of the state of the internal combustion engine.

АННОТАЦИЯ

В данной статье описывается достижение поставленной цели, а результаты эксперимента используются для проверки теоретических разработок и обоснования диагностических воздействий на контроль состояния двигателя внутреннего сгорания.

Keywords: ECM, ICE, vehicle, combustion engine, adapter, diagnostic parameter, engine diagnostic.

Ключевые слова: ЭБУ, ДВС, автомобиль, двигатель внутреннего сгорания, адаптер, диагностический параметр, диагностика двигателя.

The purpose of the experimental studies is to check and refine theoretical developments on the multi-level system of ESM diagnostics.

Achieving this goal requires completing the following work steps:

- Development of specific experimental research methods;
- Selection and development of technical diagnostics tools, equipment and devices for recording output indicators;
- Carrying out each of the stages of experimental research according to the developed private methods;
- Determination of the limit values of diagnostic parameters;
- Verification of the adequacy of theoretical developments.

The obtained results of the experiment are used to test theoretical developments and justify diagnostic conditions for monitoring the state of the internal combustion engine ECM(3).

The measuring instruments used for this purpose must provide an accuracy of 0.2-0.3 of the value of the tolerance field of the controlled parameter.

The standard program "Motor Tester" is prepared for testing and connected to the vehicle system in accordance with the rules set out in the operating instructions.

To ensure the uniformity of the experiment, objectivity and compare ability of the results obtained, the remaining values of the experimental ICE with distributed fuel injection are provided unchanged. During the entire research cycle, the following conditions were observed: all experimental test data are brought to atmospheric conditions as close as possible to normal: air temperature293 K (+20 °C);barometric pressure B = 101.3 kP_a (760 mmHg); water vapor pressure 1.2 kPa; fuel temperature at the input to the motor power supply system t=+20 °C / 66, 61/.

Other restrictions are reflected in the developed private methods. Based on the previously presented multi-level engine diagnostics system with ECM, a technological process diagram is developed, as shown in Figure 1.1(4)

The assessment of complex indicators includes obtaining data on the state of the internal combustion engine based on power, fuel consumption and environmental indicators. A portable PC with the standard program "Motor Tester" is installed in the car and connected via an RS-232 cable and an adapter to the on-board diagnostic pad. The adapter is powered by the car mobile battery. The connection diagram of the PC to the vehicle is shown in Figure 1.2.(6)

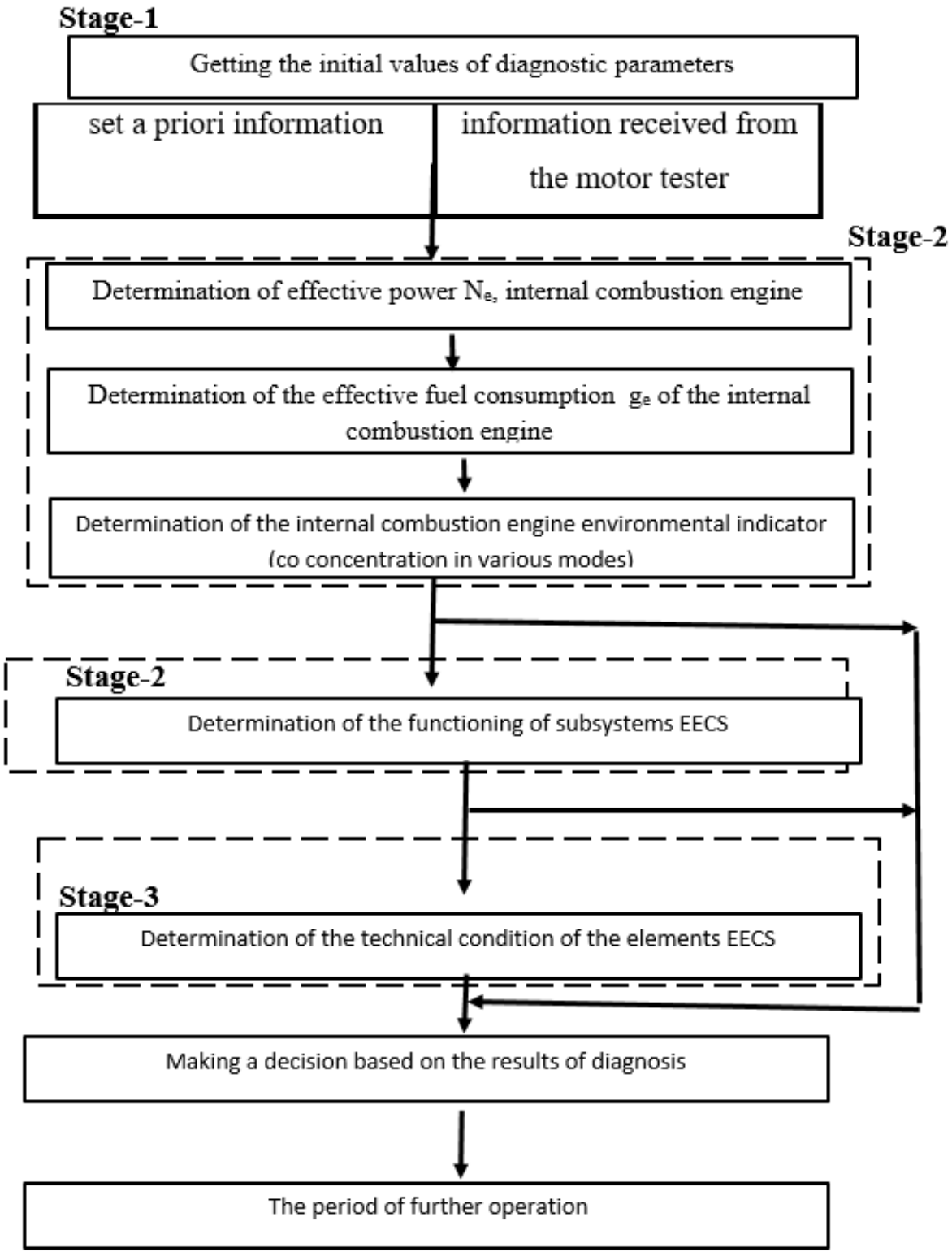

Figure 1. Engine diagnostics technology with EECS

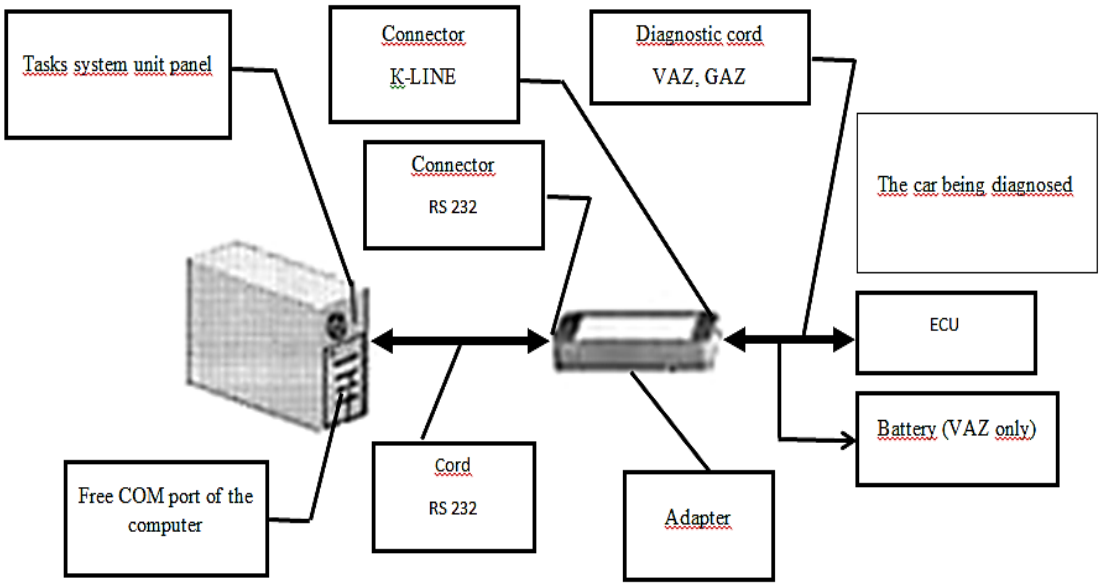

Figure 2. Connection diagram of the PC to the vehicle (7)

The assessment is made when driving in acceleration mode with the throttle fully open in 3rd gear on a horizontal section with an asphalt-concrete surface. Initial conditions: the speed corresponds to 40 km / h, the crankshaft speed is 1000 rpm.

A flowchart for getting information from the engine is shown in Figure 3.(2)

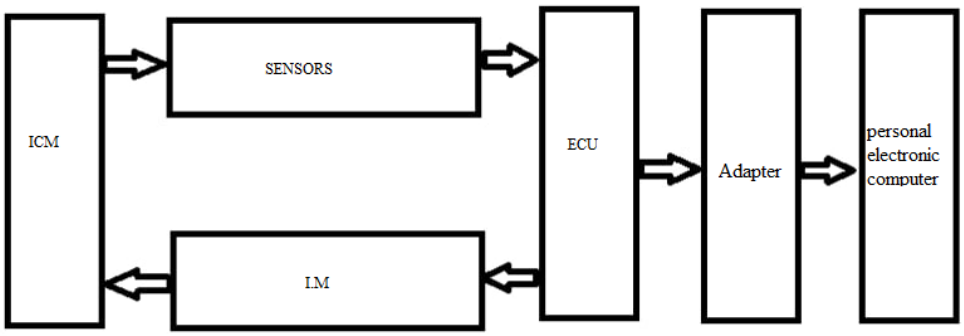

Figure 3. Блок-схема получения информации от двигателя

Variables obtained with the vehicle in driving mode are shown in Table 1.

Table 1.

Display variables of the "BOSCH M l,5.4" , "BOSCH M1.5.4 N" and "JANUARY 5.1" blocks used in calculations(8)

Code	Bosch M1.5.4	Bosch M1.5.4 N		Units of measurement,	Note
COINJ	•	•	Injection time correction factor		Data is recorded and viewed at any given time
FAVAL	•	•	Air/fuel ratio		
FREQ	•	•	Crankshaft rotation frequency	Tp/min	
FUELPK	•	•	Specific instantaneous fuel consumption	l/100km	
JAIR	•	•	Mass air consumption	Kg/h	
JSPEED	•	•	Vehicle speed	Km/h	
THR	•	•	Throttle position	%	

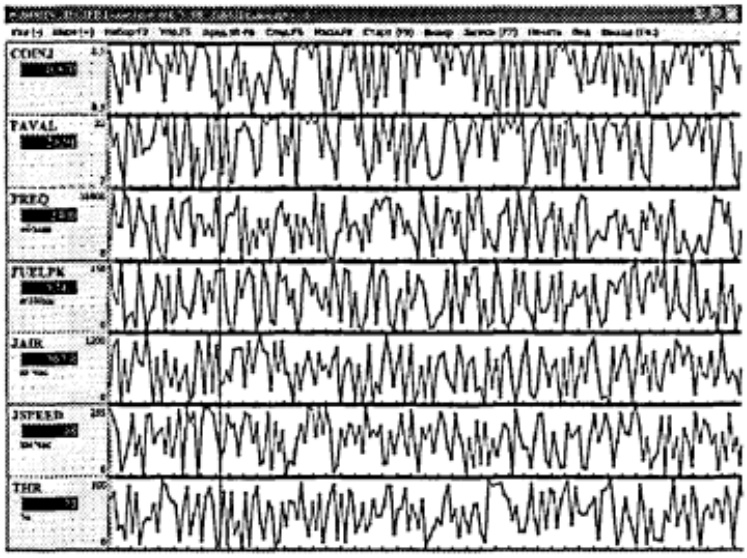

Figure 4. View of the received data from the "Motor Tester" program (9)

Further processing of data obtained from the standard program "Motor Tester" is performed manually by the operator in the "Write down" mode. In this mode, by moving the visor, you can view the values of seven diagnostic parameters simultaneously at any time. The obtained data are entered into the program" Power, specific fuel efficiency and ecology" developed by the author, presented in Appendix A, to obtain the values N_e, $g_{of\ ne,\ g\ e,}$, $P_{экол}$ depending on the speed of rotation of the crankshaft. This program provide number of fixed values used for calculation, which are shown in Table 1.2(5)

Table 2.

Accepted values for calculating complex indicators

Designation	m_a	g	G_a	f_o	i	C_x	F_x	U_{tr}	δ	η_{tr}
Dimension	Kg	m/s^2	H	-	-	Hc^2/m^4	M^2	-	-	-
numerical meaning	1370	9,81	13439	0,017	0	0,339	1,965	1,357	1,142	0,89

Data on atmospheric conditions is also entered into the program, so that the obtained parameters can be compared with each other. The program outputs parameter data in the form of tables and graphs(1).

The performance and economic parameters of internal combustion engines depend on environmental parameters such as pressure, humidi typa, and ambient air temperature. GOST 14846-69 and GOST18509-73 regulate the standard conditions given in the general methodology(10).

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