CONDITION BASED MAINTENANCE OF FOREST MACHINES HYDRAULIC DRIVES

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The structural identification of hydrostatic drive HST-90, HST-112 diagnostic model is implemented set on forestry machinery. The differential dependence of transitional process of dynamic system pump-engine is formalized. From the analysis of equations that the parameters which characterize the technical condition of the pump and motor are the time constants of the transition process, as well as the damping decrement of the liquid in the pressure line, and engine speed. The solutions have been obtained of differential equations.

Volumetric hydraulic drives are widely used on mobile forestry equipment as a system for transferring energy from the engine to the propulsors of the machine during technological operations. The technical condition of such hydraulic units as an axial piston pump (PP-90,112) and motor (PM-90,112), largely determines the performance of the machines as a whole, because affects their speed. Change in technical condition HST-90,112 for the worse, leads to losses in the form of increased overhead costs of energy and fuel [1], due to volumetric losses of the working fluid due to internal leaks through the gaps (from high pressure zones to low pressure zones). During operation of hydraulic machines due to wear, volumetric losses are constantly increasing.

Volumetric losses of hydraulic drives are determined by the delivery coefficient for pumps and the efficiency coefficient (efficiency) for motors.

According to DSTU 2192-93 [2] the criterion of the limiting state is the reduction of the feed coefficient $\square_p$ for pump and efficiency $\square_m$ for the motor no more than 20% of the initial values.

In work [3] analysis of the wear of the main elements HST-90, regularities of the distribution of wear are revealed and a mathematical model of the relationship between volumetric efficiency with wear and gaps in tribosystems is obtained HST. One of the directions for diagnosing hydraulic drives is thermometry [4], which allows you to determine the technical condition of the temperature of the pump housing and motor during operation. This method was further developed in the work [5], where, according to the results of temperature measurement, individual nodes of the hydraulic pump are diagnosed, however, the relationship between the temperature regime and the technical condition of individual nodes has not been established.

The authors of the work concluded that the hydraulic drive of the forest machines hinged system is described by an oscillating link, and the technical condition can be estimated from the characteristics of the transition process. Analyzing the transfer functions of the hydraulic steering gears, mounted system and gearbox, the authors [4] conclude that these systems can be considered as dynamic oscillatory systems with a low damping coefficient. The number of transients can be determined by the following indicators, fig. 1:

- transient time t_t;
- time t_m, at which the pressure reaches its maximum value P_{max};
- time t_1, for which the fluid pressure first reaches the static pressure value, P_{stat};
- - overshoot;
- - steepness, angle.
- - oscillation damping period.

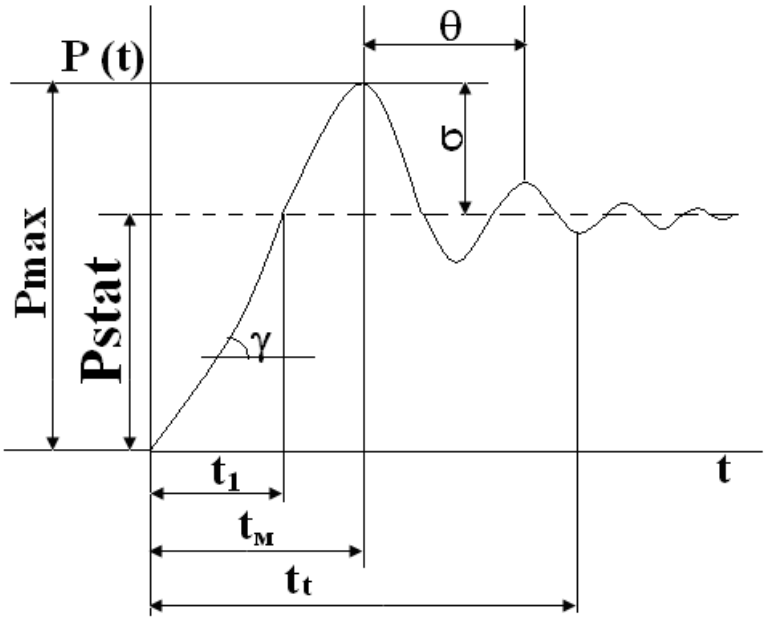

Fig. 1. Oscillation transient quality indicators [6]

The authors of the work [3] it is proved that the listed indicators, fig. 1, have a connection with the technical condition of the hydraulic actuator, while the pressure build-up intensity $\dot{P}$, is the most informative parameter of the technical condition of the hydraulic pump.

In works [3, 5] made structural identification diagnosis of the hydrostatic drive models HST-90. The differential equation of the transient process of the dynamic pump-motor system is obtained. From the analysis of the equation it follows that the parameters that characterize the technical condition PP-90 and PM-90 are the time constants of the transient process of the pump and motor, as well as the decrements of attenuation of fluid oscillations in the pressure line and the engine speed. In this work, the relationship between the pump and the motor is taken into account, but hydraulic leaks are not taken into account, which reduce the efficiency of hydraulic machines.

Conclusion. Structural identification of the mathematical model for diagnosing a volume hydraulic drive has been performed HST-90,112, set on forestry machinery. The structure of the model includes the relationship pump-motor-hydraulic fluid leak. From the analysis of the differential equation of the transition process of the dynamic system it follows that the parameters that characterize the technical condition of the pump PP-90,112 and motor PM-90,112, are time constants, as well as damping decrements of fluid pressure fluctuations in the pressure line and engine speed. The listed parameters are diagnostic according to the assessment of the technical condition HST-90,112. Solutions of differential equations are obtained that allow simulating a transient in a dynamic pump-motor-hydraulic fluid system.

References

1. Gorbatov V.V. Analysis of influence of change of technical condition of hydraulic drives of cyclic action of agricultural machines on fuel consumption / V.V. Gorbatov // *Problems of reliability of machines and means of mechanization of agricultural production: Bulletin of KhNTUSG them. Petra Vasilenko*. - Kharkov: KhNTUSG them. Petra Vasilenko, 2008. - VIP. 69. P. 268-273.

2. DSTU 2193-93 Hydraulic actuators are three-dimensional. Volume pumps and hydraulic motors. General specifications.

3. Boiko I. G., Voitov A. V., Vojtov V. A. Structural identification of the mathematical model of diagnostic capacity hydraulic drive HST-90.112 // *Scientific Bulletin of National University of Life and Environmental Sciences of Ukraine. Series: APC equipment and energy*-K. – 2015. – №. 226. – C. 124-132.