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МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ТРАНСМИССИИ ШАХТНОГО САМОСВАЛА
MATHEMATICAL MODELLING OF THE UNDERGROUND DUMP TRUCK TRANSMISSION

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The MoAZ underground dump truck has a hydromechanical transmission, including lock-up torque converter and constant-mesh gearbox. The gearshift is performed by an electronic control system which improves the performance of the truck. During gearshift the gearbox clutch operation is characterized by a high level load on the friction plates and high pressure on the friction surfaces. As a result, the clutch load calculation is a crucial step of overall transmission control. Thus, the purpose of the research is transmission mathematical modeling with the transient response analysis during gearshift.

The initial phase of the mathematical modeling is to create a dynamic model of the object of research. Its construction is based on the law of conservation of energy, which allows reflecting the physical processes of the technical object function correctly. Significant attention is paid to the adequate representation of the structure of the object.

The development of dynamic models of hydromechanical transmission was carried out taking into account the need to identify the dependencies between the quality indices of transient processes and the main parameters of transmission, influencing the character of the transient response.

The maximum torques $M_{y\max}$ in the transmission elements and dynamic factors $k_{\text{д}}$ were taken as the indicators of the quality of the transient response during gearshift. At the same time the operation processes of the gearbox clutches were evaluated.

The dynamic factor can be defined as

$$k_{\text{д}} = \frac{M_{y\max}}{M_{e\max} u_{\text{тр}}},$$

where $M_{e\max}$ – the maximum engine torque; $u_{\text{тр}}$ – the transmission ratio at current gear.

The specific power and specific slip work of engaged clutches were taken as the criteria for assessment of these processes.

The structure of the developed transmission mathematical model helped to identify the dynamic load on the propeller shafts, gearbox shafts, on the axle shafts and tires.