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OPTIMIZATION OF HYDRAULIC DRIVES FOR SYNCHRONIZING THE WORKING MOVEMENTS OF THE MACHINE FOR AUTOMATED BRICK PRODUCTION

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Abstract: In the practice of designing hydraulic drives, one of the difficult tasks is the synchronization of the movement of two or more cylinders. In order to provide several cylinders with the same speed of movement, they must be provided with fluid flows of equal magnitude. Changes in workload, characteristics and parameters of hydraulic units, fluid leaks, friction force in cylinders and actuators have a significant impact on the dynamics of such systems. An urgent task during design is the selection of optimal parameters that directly affect the synchronization error. The paper presents a version of the improved string cutting machine for forming bricks with two hydraulic drives. The hydraulic scheme of the machine was developed and the principle of its operation was described. A mathematical model of the movement of the traverse and the carriage of the machine for forming bricks, which require synchronous actions in the process of work, has been compiled. The dependence of the total force of the technological load and friction acting on the traverse on the movement parameters and tool geometry was obtained experimentally. The obtained dependence was used in the development of a mathematical model. The mathematical model is represented by a system of nonlinear differential equations that were solved by the Rosenbrock method. A block diagram of the solution of the equations of the mathematical model is given and a simulation study of the dynamics of the movement of the traverse and carriage of the installation in the MATLAB-Simulink environment is carried out. The main structural parameters of hydraulic drives were determined and their influence on the movement time and the error of the carriage of the automatic brick forming machine was determined. The dependences of movement time, carriage movement error, productivity and used power of the automatic machine on the values of design parameters were obtained. A complex criterion for evaluating the efficiency of the automatic machine was formed and the values of the structural parameters of hydraulic drives were found, in which the errors of the geometric dimensions of the products and the power consumption will be minimal, and the productivity of the installation will be maximal.

Key words: automatic brick forming machine, hydraulic drives, synchronization, mathematical model, complex criterion, optimization.

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