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DEVELOPMENT OF A MATHEMATICAL MODEL FOR COMPUTATION OF PERMISSIBLE OPERATING PARAMETERS OF THE SUCKER-ROD PUMP VARIABLE-FREQUENCY DRIVE

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Abstract

The paper discusses the issues of regulating the swing frequency of the pump jack balance beam of marginal wells, from which oil is produced using sucker rod pumps, associated with switching the wells from intermittent to continued operation. A mathematical model, which comprises the mathematical models of the pump jack and driving motor, allowing solving the problems of regulating the balance beam swings frequency according to the flow rate variation on the basis of the electric drive complex model, was developed. The filling of the pump with liquid defines the shape of the load curve, and therefore it is the basis for determining the law of load torque variation. There was proposed a method of computing the static characteristics of the induction motor driving the pump jack, taking into consideration the periodically variable load torque and moment of inertia of the working parts. The periodic dependencies of the coordinates of the steady-state mode of the electric drive are computed by solving a boundary-value problem. The proposed mathematical model makes it possible to determine the dependencies of the current, power, electromagnetic torque and other significant operation parameters on the amplitude and frequency of the induction motor supply voltage in order to estimate the maximum permissible values. It can be used for designing and adjustment of the variable frequency drive of the sucker-rod pumping unit, which ensures the continuous

operation of the marginal well consistent with the flow rate variation. References 11, figures 5.

Key words: sucker-rod pumping unit, marginal well, asynchronous electric drive, steady-state mode, boundary-value problem, static characteristics, frequency regulation.

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