Model for a Direct Torque Control System of an Alternating Current Electric Drive for Urban Transport Rolling Stock Tasks

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Abstract. A mathematical model has been developed in the paper of the direct torque control (DTC) system of an alternating current (AC) electric drive for the tasks of the urban electric transport rolling stock, as an alternative to the existing types of frequency control of an induction motor, taking into account its relevance, principles of operation and causes of occurrence. During the research on the mathematical model of direct torque control of an induction motor on the MATLAB platform, its main disadvantages have been revealed, which limit the scope of its application. The main task of the DTC system is to identify the stator flux linkage, which is solved by integration with a certain accumulation of errors. The source of accumulated errors is the inaccuracy when determining the stator active resistance and its change during the induction motor operation. The DTC system is characterized by the disadvantage of torque pulsation occurrence and rotor speed fluctuations at low loads. The main advantage of the DTC system has been determined – high static and dynamic speed accuracy. The results of mathematical modeling and the presented sequence of studies are of practical value in the development and adjustment of complete electric drives with a DTC control system for railway transport mechanisms. New is a technical solution that acts as an alternative to a complex vector control system - this is the use of the DTC system for the tasks of the rolling stock of urban transport.

Keywords: Induction motor · Frequency converter · Voltage inverter · Direct torque control · Torque controller · Flux regulator · Observer

1 Introduction. Analysis of Literary Sources and Statement of the Problem

For the first time, the method of an induction motor direct torque control (DTC) was patented by ABB (Asea Brown Boveri Ltd) Company. The implementation of the method

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