DESIGNING PRINCIPLES OF NOVEL GENERATION OF HYBRID DRIVES WITH AC INDUCTION MOTORS FOR RAILWAY TRANSPORT

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The prospects for the use of multiphase (i.e. having the number of phases more than four) asynchronous linear and non-linear drives in the field of railway transport were presented and described by the authors of this work in [1-5].

However the increase of the phase number of asynchronous electric drive system allows not only to improve a number of its technical-and-economic characteristics, but also to create the hybrid traction drives according to scheme “Diesel-generator – AC induction motor(s)” which will differ fundamentally from the existing ones, and have more simple design and control unit and less energy losses (in comparison with analogous existing hybrid drives). These hybrid traction drives of novel type are based on the use of the multiphase Diesel generators and non-traditional controlled multiphase AC induction motors.

The basic principles of design of these hybrid traction drives of novel generation are presented in this paper. These basic design principles are the following:

1) the increase of Diesel generator and AC induction motor phase numbers more than four;

2) the application of such non-traditional method of control by multiphase AC induction motor as the phase-pole method (PPM);

3) the use of a number of novel design versions of multiphase AC induction motor.

PPM-controlled multiphase AC induction motor is in effect a multi-speed motor having only one winding set that is equal (in its complexity) to the winding set of 3-phase single-speed AC induction motor. The quantity of discrete values of the motor speed rises if the phase number of PPM-controlled multiphase AC induction motor increases.

Because of this there is no need to use a transistor inverter in such multiphase hybrid traction drive to regulate the AC induction motor rotor speed. The corresponding thyristor or electromechanical commutator is used in the multiphase hybrid traction drive of novel type instead transistor inverter. The operating frequency of such commutator is much less than the operating frequency of above mentioned inverter IGBTs. Owing to this the energy losses are much less and the motor control process is significantly simpler in the multiphase hybrid traction drive of novel generation (in comparison with the analogous existing hybrid drives).

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