NEW ACHIEVEMENTS IN THE FIELD OF MULTIPHASE AC ELECTRIC DRIVES

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Below the effective analysis methods, accurate mathematical and computer models of inverter AC motor drives with different phase numbers, non-traditional control methods of multiphase motors and some other creations are suggested.

Currently the increase of phase numbers (more than four) of inverter AC electric drives is one of the lost effective methods of improving of technical-and-economic indexes of these systems. The investigations, engineering developments and creations of multiphase drives are now under way in many countries of the world.

The results of the investigations indicate that as the growth of the phase numbers of inverter electric drives increases so the efficiency of the motor does, the possibility to expand the diapason of adjusting the rotor speed down from its nominal value and to decrease mass-and-overall dimensions of electric drive systems appears. Besides, the increase of phase number is one of the most effective methods of expansion of AC transistor electric drive power diapason in the direction of the increase of these powers.

At present the wide implementation of AC multiphase (with phase number more than four) drives fails because of the lack of the enough accurate analysis methods, mathematical and computer models, computational and construction methods of such systems.

In particular the most accurate of the existing models do not allow to take into account non-sinusoidality of magnetic induction distribution in the air gap of the motors with the phase number more than four. As the results of our investigations showed the influence of the induction distribution form in the air gap on the technical-and-economic motor indexes increases with the increase of the phase numbers which is necessary to take into consideration.

In this connection the problem appeared to create analysis methods and models of multiphase inverter drives with phase numbers more than four, the accuracy of which would be higher than that the existing analogues have. We managed to solve this complex problem and to create:

1) analytical solution methods of differential equation systems describing electromagnetic processes in inverter AC electric drives with any phase numbers;
2) packet of accurate mathematical and computer models of drives with phase numbers of three, four and more;
3) packet of non-traditional control methods of drives with phase numbers more than four.

The use of the created methods allows to get accurate analytical solution of AC drive differential equations with any phase numbers without application of any linear transformations. The created mathematical and computer models allow to take into account the control algorithm of inverter valves, magnetic induction distribution form in the motor air gap, transition processes occuring in the valves of the inverters and the whole number of other factors with the required accuracy to the user. The experimental investigations showed that the process modeling error in the drives with the use of the suggested models with any phase numbers does not exceed 5 %. In addition the created mathematical models lay be successfully used for conducting analytical investigations of the processes in multiphase drives.

The results of the conducted investigations indicate that the increase of the phase number of the inverter AC electric drive has one more important advantage: in systems with phase number more than four the possibility appears to use a number of non-traditional control methods of motor, which in principle cannot be realized when the phase numbers equal to three or four. The use of these non-traditional control methods allows essentially to expand adjusting possibilities of multiphase drives.

Now the whole complex of research works in the field of electric drives with the phase number more than four is being carried out. These works include also the works on creation of original multiphase system of induction motor drive are related, which is intended in the first place for the electric motor cars and some machine tools, and the whole number of other works is related to this number as well. The results of the conducted investigations indicate that the concept of a big phase number (more than four) of inverter AC electric drives has its logic continuation. And now in this direction the investigations based on critical reunderstanding of some fundamental principles of electrodinamic theory are being carried out.