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Analysis of operation of an induction motor supplied with voltage containing subharmonics and interharmonics using a field model

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ABSTRACT

The thesis concerns an analysis of an induction motor supplied with voltage containing subharmonics and interharmonics using a field model. For the purpose of computation, an electromagnetic field model implemented in ANSYS Maxwell environment and a thermal circuit model are applied. Currents, power losses and windings temperature of a 3-kW cage induction motor are investigated for voltage subharmonics and interharmonics of various frequencies and a load of diverse properties. The results of research shows that the moment of load inertia has a significant effect on steady-state currents, power losses and windings temperature of the low-power induction motor under voltage subharmonics and interharmonics. Additionally, the load torque-speed characteristic has an influence on steady-state currents, power losses and windings temperature of the low-power induction motor supplied with a voltage containing subharmonics and interharmonics. Application of a field model is useful for determination of the normative levels of power quality disturbances under consideration.

The thesis contains five main chapters. In the first chapter, an introduction to the problem, the state of the art, the goal and scope of work are presented. In chapter 2, methods of analysis of an induction motor supplied by voltage containing subharmonics and interharmonics, the issues of power loss and thermal phenomena are described. Also, the development of a field model of the induction motor, its validation and coupling with an existing thermal circuit model are presented. The third chapter includes an analysis of the currents of an induction motor under subharmonics and interharmonics, for different moments of load inertia and various torque-speed characteristics of the load. Chapter 4 is devoted to temperature and power losses of an induction motor supplied by voltage containing subharmonics and interharmonics. In the final chapter, conclusions and directions for future research are formulated. At the end of the paper, the appendix presents the method of elaboration of 2D and 3D field model, as well as codes for a computer application for power quality analysis.

Keywords: *FEM modelling, induction motor; interharmonics; power losses, power quality, subharmonics; temperature, voltage waveform distortions.*

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