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Analysis and Estimation of Values of Currents and Voltages at the Disturbances in Induction Machine Using Tested Matlab Simulation

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Abstract—The paper we presents mathematical model for analysis of transitional processes in three-phase induction motor, that is, wave forms of currents and voltages in time domain and phase coordinates. Model is suitable for relay protection of the motor from disturbances and for estimation of electrical energy quality in the distribution network. New constructions of induction motors present more progressive technical solutions comparing with classical variants and reliable entity only within selected system of protection from expected disturbances (failures and disorders followed by asymmetries). Measuring process is not required due to application of simulation in selected MATLAB package.

Index Terms— Mathematical Model, Quality of Electric Energy, Three-Phase Induction Motor, Relay Protection, MATLAB.

I. Introduction

Asymmetric, non-linear and variable loads in the network, what essentially induction machine is, cause emergency flows of active and reactive powers, new power losses and increased heating [1,2]. In selected mathematical model and with the computer assistance it is possible to determine asymmetry conditions and to estimate the additional losses $m-3$ of phase-distorted loads arising from the fundamental and higher harmonics of asymmetric voltage and current components [3,4].

There are two mathematical models for examination of normal and transient processes in the electric machine, electrical and thermal, whose models contain the following quantities: voltage, current, magnetic fluxes, mechanical torques, velocity, and power [4,5].

Asymmetric regime of polyphase electrical energy feeding system is the state in which working condition of certain phases are not standard. Regimes with distinctive asymmetries and distortions of electrical quantities, currents and voltages, in transient machine process and its exploitation-operating characteristic also depend on the parameters of thermal losses in the machine [6,7].

There are two types of asymmetries, short-time asymmetries, arising in the overload regimes, short-circuits or open conductors in electrical networks; and long-time asymmetries arising due to different phase parameters or switching of asymmetric loads [8-11].

During machine operation different disturbances can occur: faults and perturbations that can affect the machine behavior.

The selection of the relay protection of the motor mainly is influenced by the following factors:

- power and dimension of the motor,
- the type of electrical network and the grounding determined by standards,
- the importance of the induction machine in the plant and in expected type of disturbance.

According to IEC standard [8,12] and the type of relay protection, induction machines are classified into two groups:

- induction machines with power $P<100\ kW$; application of these motors with appropriate system of relay protection can be more reliable and more cost-effective than the use of any electrical machine,
- induction machines with the powers grater than $P>100\ kW$; according to economic criterion they have no advantages over synchronous or special machines, but are irreplaceable in terms of reliability of

