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ABSTRACT

Doctoral dissertation

„Transient and steady-state analysis of single-phase self-excited induction generator"

The doctoral dissertation consists of seven chapters and a list of references.

The first chapter contains a general introduction to induction generators, a review of literature related to the topic of the dissertation, and formulates a goal and scope of the work. The second chapter presents a scope of the research conducted in the framework of the doctoral dissertation. The chapter also describes the object of the study (the single phase induction machine, designed for motor operation) and a laboratory setup for experimental validation of simulation results.

The third chapter deals with mathematical modeling of a single-phase, self-excited induction generator. Circuit models, commonly used in analysis of self-excited induction generators, were presented. The most space is devoted to field-circuit model of the generator. This model was validated by experiments and used for simulations presented in the dissertation.

The fourth chapter presents the analysis of self-excitation phenomenon in a single-phase induction generator. Three methods of approximate modeling of remnant magnetism in the machine's magnetic core were proposed. An influence of rotor slot opening on self-excitation process in the generator was examined.

It is noted, that self-excitation of a single-phase induction generator may not occur, if its rotor cage has closed slots, even in the presence of remnant magnetic flux.

Steady-state analysis of a single-phase self-excited induction generator was presented in the fifth chapter. Four topologies of capacitors connected to the stator windings were investigated. An influence of the rotor speed on output characteristics of the generator was examined. A possibility to expand the operating range of the machine up to its rated power was noted – it is necessary to apply a series capacitor in the main winding of the generator.

The sixth chapter concerns the short-circuit condition of a single-phase self-excited induction generator. A short-circuit state and a re-excitation that occurs after removal of the short-circuit were analyzed, for all considered capacitor topologies. Experimental investigations of the short-circuit were limited only to the basic topology, to avoid the damage of the generator.

The seventh chapter contains a summary of the work and conclusions. It also includes suggestions for further work on the optimization of construction of single-phase self-excited induction generator.

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