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Abstract of the doctor's thesis entitled:

The use of parallel active power filters controlling voltage in the power line in distribution systems

The dissertation concerns the use of power electronic converters as parallel active filters in order to suppress higher voltage harmonics in power networks with relatively low short-circuit power (so-called "weak grid"), including branched ones.

The main goal of the paper was theoretical and simulation analysis, and then the implementation of the laboratory model of parallel active power filter, controlled in the basis of the identification of harmonic components of the supply voltage (behaving like selective conductance) and finally, evaluation of its properties and usefulness in weak grids.

The following thesis of the work was formulated: „It is possible to improve the power quality, both for delivery and consuming in distribution systems through the use of unconventionally controlled parallel active power filters controlling voltage in the power line, operating on the principle of shunting harmonic voltage disturbances with selective conductance, which allows to avoid communication between compensators in distributed systems and is particularly effective in weak networks, including marine grids.”.

The paper consists of thirteen main chapters, of which 7-12 are the research part. In order to do research, a model of an active power filter based on the identification of a voltage deformation was developed. A method of stability estimation of the tested model was proposed and next, selected static characteristics of tested active power filter were determined.

Behaviour of the active filter in a network with deformed voltage waveforms (disturbed both from the power source and from the consumers' side) was simulated as well as the behaviour of the tested device in dynamic/transient states. The operation of several filter units within one branched power grid was also analysed. Then, a laboratory model was developed and with its use, the operation of the active filter system controlled on the basis of the proposed algorithm was experimentally verified. The last chapter is a summary of the dissertation.

The most important achievements of the work are: development of an active power filter control algorithm and its software implementation in the C++ programming language, development of the method for stability analysis of an active power filter controlled with the proposed algorithm, a series of studies on selected features of the considered active power filter, the construction of a laboratory model (both, power circuit and the author's digital controller) and experimental verification of some of its features.

The findings presented in the paper show the effectiveness of the considered solution in weak networks, thus justifying the truthfulness of the thesis. Moreover, they show that the subject of the dissertation is a very broad issue, and thus impossible to exhaust within a single study. This opens the way for further work on unconventionally controlled active power filters operating in distribution networks.