

The aim of the project is to develop the small-signal models voltage inverters designed for use in systems of guaranteed, uninterruptible power supply (UPS), taking into account the impact of DC / DC converters (impedance networks) to increase the input voltage. The analyzed will be the impact of changes in actual parameters cores chokes made of soft magnetic materials for resonant frequencies. In the project will be conducted work on designing digital resistant voltage inverter control systems that meet the requirements of the applicable standards (delimiting the maximum allowable output voltage distortion UPS) operating with static and dynamic, linear and non-linear loads. Will be carried numerous software simulations voltage inverter models, the replacement models take into account the input circuits. During the the project is expected to design, assembly and test new, experimental models for single-phase inverters. Foresees to carry out research on the dynamics of inverters, impedance networks using photovoltaic solar panels. They will also be analyzed levels of electromagnetic disturbances impedance network structures. Tests and research on new models, with implemented, dedicated software will the determination of of real values property taking into account voltage inverter used in the cores of choke soft magnetic materials.

Basic research carried out under the project will concern the modeling small-signal voltage source inverter models with impedance networks, allowing for description of the dynamics the system. The research will be supported by numerous simulations programming. The work will be aimed to determine static and dynamic properties inverters with impedance networks that use proposed and implemented SISO and MISO controls loops. It seems that the final goal of the project for a generalized approach to control system design voltage source inverters with networks is exactly part of the definition of basic research.

Obtaining a nominal AC output voltage of 230 Vrms at power voltage source inverter from a low voltage source such as batteries, photovoltaic cells or fuel cells, requires the use of one of the many solutions. Another commonly used solution is the duplication of sources, which is expensive and not always possible to implement due to the size solution. Alternative solution is the use of booster transformers variable output voltage or the use of converters DC / DC booster DC voltage. Currently, the new type of circuits are used increasing voltage is Z-Source and its derivatives (eg. qZSI, SIZSI, T-ZSI, LCCT-ZSI, CqZSI and many others). Impedance networks (systems ZSI) in their physical structures use such basic elements as chokes, capacitors, diodes and transformers.

One of the most frequently used common materials used in the cores of magnetic chokes and transformers are materials with iron-powder. The change of parameters of magnetic cores (the iron-powder material) used in choke, the implementation of impedance network can change the characteristics frequency of the transfer function of an inverter control, which consequently influences the selection of the control loops system of the voltage source inverter. The reason is that the magnetic properties of the material are non-linearly related to the amplitude and frequency of the magnetizing current. Increasing voltage input circuits convert the input power by using energy storage effect in inductively. These non-linear effects additional others resonant frequencies to transfer function. The result is that the required a more comprehensive controller (higher order) than in the case of voltage source inverter powered directly from the battery. Voltage converters are usually modeled using a state-space averaged method.

So far in any of the works presented the results of deliberations on the side effects of the use of impedance network structures. Nobody paid attention to the output voltage distortion occurring independently of used structure. No analysis of additional entering the power loss during the inverter operating impedance networks, as well as a decrease in the efficiency of such systems. There have been no studies to date on the electromagnetic disturbances introduced by the network impedance.

UPS systems studies on low and medium power are very important, because usually these systems are designed to supply computer systems. Hence the need to take into account the typical non-linear loads defined by EN 62040-3, rather than the standard industrial load RL. Voltage source inverters analyzed in the project are a major part of the guaranteed voltage systems. Modeling inverters allow the project to formalize their control is very important. The analysis presented in the project should also make it possible to choose the right system (suitable type of network impedance) boost the input voltage. It appears that the inverters without output transformer, but the inverter input DC / DC converter will be typical for the range of low and medium power because of their low cost and weight. Final goal of the project is to develop a generalized approach to design the voltage source inverters based on the results obtained during the project as well as research conducted to date related to the PhD thesis and using the knowledge and experience of the academic supervisor. It seems that the presented results of the project will have an impact on the development of power electronics systems in terms of guaranteed power supply.