Power electronics converters are more and more popular as the grid interfaces in the electric loads (active rectifiers) as well as they are the key components in all unconventional power generation systems such as wind turbines, photovoltaic systems and grid integrated battery energy storage systems (BESS). Classic methods of three phase power electronics converters are quite sensitive on grid voltage harmonics and there are requires adequate filtration of the control variables. Much more adverse influence on control has grid voltage asymmetry occurrence, as this type of disturbance has the same frequency than fundamental component of the voltage.

Classic aim of the control during voltage distortions and asymmetric disturbances is to keep the converter current sinusoidal and symmetrical. Other targets, such as e.g asymmetrical converter current which potentially may have positive influence on the power network voltage require use of more sophisticated control structures including resonant terms as part of the controllers for which the introduction of limitation structures (anti wind-up) is not intuitive and make troubles.

The project goal is elaboration of new control methods of grid connected power converters allowing safe operation with current limitation and high quality energy in the case of operation with high content of grid voltage harmonics and imbalance. The crucial aim is synthesis of the control methods with the use of non-Cartesian coordinates frames in which the control variables will be constant independently on the harmonics content and asymmetry in the grid voltage as well as in controller current.

The use of transformation to the non-Cartesian frame will cause simplification of the controllers structures and easier implementation of anti wind-up, whereas the methods of reference current signals calculation depending on the grid voltage asymmetry and harmonics is a next issue which will be undertaken in the project. Intentional introduction of harmonics and/or asymmetry may help in the improvement of the grid voltage quality in the case in which the short-circuit power is relatively low in relation to the rated power of converter (high impedance grid).

Project realization requires mostly analytical studies, determination of factors of control variables transformation to the new coordinates frames, finding the influence of the converter current on the distorted and unbalanced grid voltage at given relation between grid impedance and converter power, determination of reference current signals for different targets, and finally verification of calculations in the simulation models and laboratory tests.

Obtained results may help in an increase of energy quality consumed by the loads with three phase power electronics grid interface or produced in unconventional electrical energy sources, especially in the distributed grid with high penetration of these kind of sources.