The Influence of Power Converters Built with Power Semiconductor Devices on the Quality of the Electrical Energy

Kamen Seimenliyski[1], Tzanko Zanev[2], Pavlik Rahnev[1], Silvija Letskovska[1], M. Uscheva[1]

Abstract - **In the last years and in the present there is a tendency most of the produced electrical energy to be used in the converted type.**
In the process of the conversion of the energy the condition for regulation and stabilization of the parameters are realized, together with the possibility for automation of the technological processes. That is why the problems connected with power devices and converters built with them simultaneously arise.
In this work same of these problems are investigated as well as the factors generated them.

Key words - **regulator, converters, electromagnetic comp tability.**

I. Introduction.

One of the most serious problem, arising in the interaction between converter devices and power net is the harmonics generation of the supplied current. The reason of this is a nonlinear converters input as a result of that the current consumed from the net does not have sins form. The additional effects, depending on the peculiarity of converting net power are next:

- Distortion the voltage form in the connection point of the converting devises (converter);
- Lowing the power factor of the energy system;
- Radiating power low frequency and radio noise via the line and ether;
- Decreasing the pass capability of the lines;
- Additional losses in the net.

In this paper the results from the investigation the processes of interaction between semiconductor converters and AC supply net are described and particularly their influence on to the harmonics in the net current.

II. Description of the methodology.

In the correspondence with [1, 6] the numerical method for analysis and modeling is applied.

[1]Pavlik Rahnev is with of Burgas Free University, Alexandrovska 101, 8000 Burgas, Bulgaria, E-mail rahnev@bfu.bg
[1]Silvija Letskovska is with of Burgas Free University, Alexandrovska 101, 8000 Burgas, Bulgaria, E-mail silvia@bfu.bg
[1]Kamen Seimenliyski is with of Burgas Free University, Alexandrovska 101, 8000 Burgas, Bulgaria, silvia@bfu.bg
[2]Tzanko Zanev is with of Tehnical University Gabrovo, Bulgaria, tsanev@tugab.bg

The subject for investigation classical circuits of semiconductor converters are used. They are for alternative voltage converting in mono phase and three phase variant with opposite – parallel connected in the phase semiconductor devises and load, connected in star with or without zero cable and in three angle. With the agreement of the accepted method for analysis [4 - 6], the ratio between converter power and supplying transformer is calculated as well as the influence of the low voltage convection line parameters and load power factor.

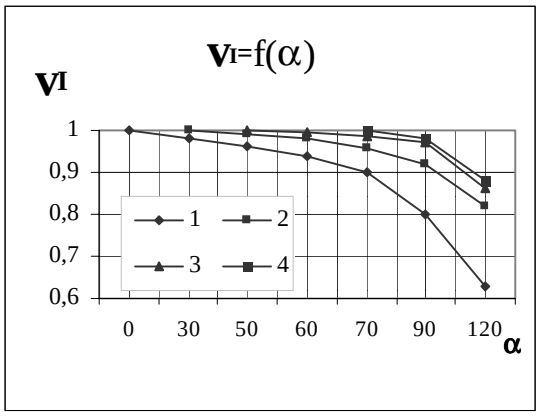

Fig 1. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

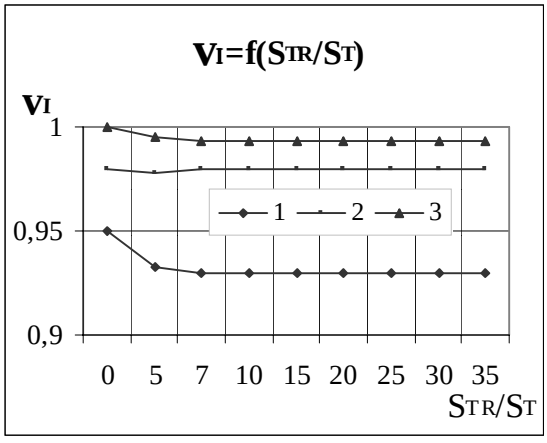

Fig 2. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7.

In the present work some of the results obtained related to the mode of phase regulation of the output power are described. From one side this method has wide application, but with strongly expressed back influence disadvantages.

The obtained results have an importance as base to compare in regulation with other methods and circuits.

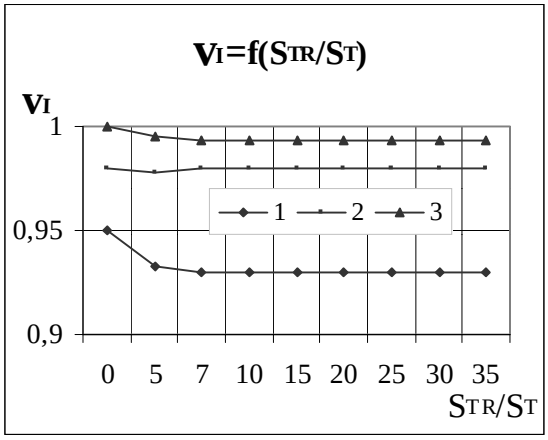

Fig 3. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

On Figures 1 - 5 the results are shown for part of the provided investigations for the dependence of distortions coefficient of the net current of the ν_I as a function of the regulating angle α and the relation between the supplied transformer power and the load S_{TR}/S_T for the parameter cosφ as follows:

1. Figures 1 – 3 – for mono phase and three phase converter with symmetrical load, star connected with presence of zero cable.
2. Figure 4 – 5 for circuits from p.1 with absence of zero cable.

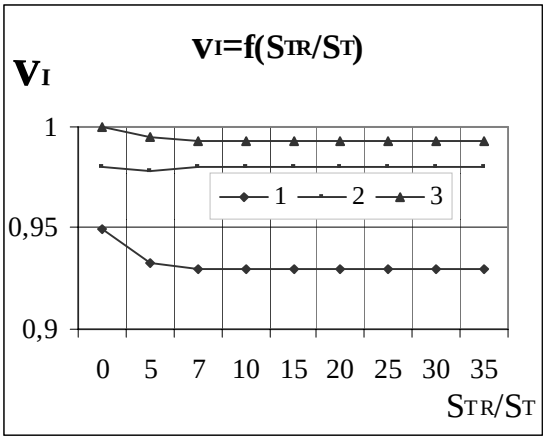

Fig 4. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

3. In Fig. 6 and Fig. 7 are shown for estimations respectively the dependence of power distortion D_0 from the regulating angle α.

From the present characteristics the next particularities could be established:

- The distortion coefficient ν_I strongly depends on the regulation angle α in the active load. In the circuit without zero cable the rate of ν_I change in is higher;
- Insignificant (up to 0.9) decreasing lowing the power factor cosφ leads to significant increasing of ν_I better seen in the circuit without zero cable. This effect could be reached using connected inductive filters;

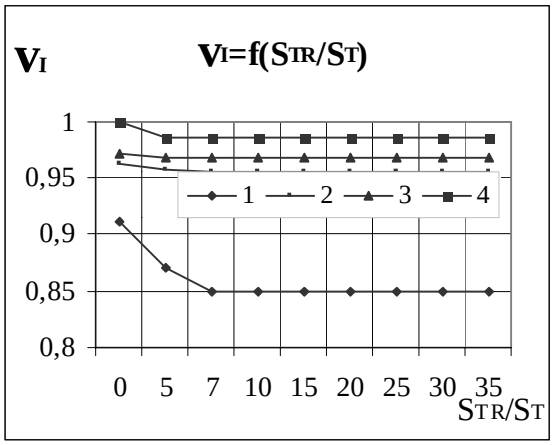

Fig 5. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

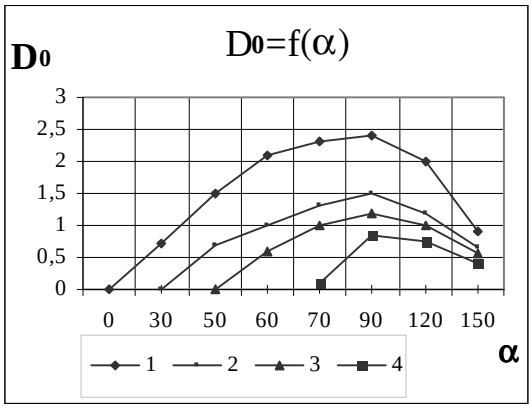

Fig 6. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

- The dependence $\nu_I = f(S_{TR}/S_T)$ appears more strong with high cosφ and small ratios S_{TR}/S_T (for $S_{TR}/S_T < 5$). The present characteristics relate

respectively for regulation angle $\alpha = 60^0$ and $\alpha = 90^0$.

The increasing influence of S_{TR} / S_T in low values on to ν_I is a result of the increasing role of the inductive resistance in the equivalent circuit, determined from transformer parameters and distribution line, connected in star without zero cable in the determined ratios between supply transformer power and a load.

- The comparison between different circuit shown that the values of ν_I for "star without zero cable" and "three angle" are almost equal and bigger than for "star without zero cable".
- The dependence $D_0 = f(\alpha)$ also shown that the disturbances in the circuit with zero cable are bigger than the other two circuit.

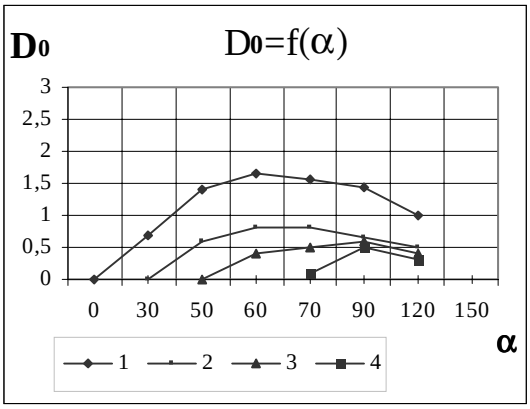

Fig 7. 1-cosφ = 1; 2 - cosφ = 0.9; 3 - cosφ = 0.7; 4 - cosφ = 0.4.

- The characteristics from Fig. 6. and Fig. 7. confirm the conclusions mode before.

III. Conclusions

The obtained results from the realized investigation, because of the its common character, have knowledge importance and in the some time ere concrete enough for practical use.

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