

OPINION

by Assoc. Prof. Orlin Lybomirov Petrov, PhD
University of Ruse "Angel Kanchev"

of the dissertation work of **mag. eng. Petar Ivanov Petrov**
on the topic "**Influence of load on reactive power in asymmetric and non-sinusoidal modes**",
presented for the acquisition of the educational and scientific degree "Doctor" in the
doctoral program "Elements and devices of automation and computing technology"
in professional direction 5.2. Electrical engineering, electronics and automation.

1. Relevance and significance of the developed scientific problem

The work analyzes in detail conventional and highly innovative settings for reactive load compensation. Currently, the first type of compensation methods is widely used in the country's industry due to its simplicity in implementation and operation, which is the reason for these methods to be studied in depth. In addition, the methodology of the regulatory framework is adapted to the construction of this type of compensating devices, which makes it preferable from this point of view. The grounds for applying innovative technical solutions based on intelligent technical settings are also analyzed. Highly effective circuit solutions are recommended for implementation, built as adaptive filter-compensation systems, minimizing several negative energy disturbances simultaneously.

Compensation of reactive loads is considered in the conditions of nonlinear and unbalanced systems, the assessment of which is presented using various power theories depending on the system load. The relative relationship between compensation of reactive loads and the quality of electrical energy is proven using analytical dependencies. The work confirms the applicability of such a complex approach to achieve effective compensation of reactive loads in various powerful industrial facilities operating under conditions of highly variable load, and also introducing significant disturbances in the quality of electrical energy.

Using the developed methodology according to the criterion "Electric energy efficiency", a study was conducted on the compensation of reactive loads in a large industrial facility with strongly pronounced nonlinear and unbalanced modes at two load levels. The feasibility of compensation was also proven at low loads, since the registered power losses from the inactive components of the power (N , S_0 and D) are comparable to those caused by the active power P .

The relevance of the study is determined by the fact that: an innovative theoretical statement was formulated according to the criteria "Electric energy efficiency" with the application of a differentiated approach to determine the components of the active losses from the inactive substances of the power in asymmetric and non-sinusoidal modes; a formulated methodological statement for determining three-phase, power-weighted indicators, which with a high degree of

adequacy, reliability and identity are appropriate to use in calculating the power factor and determining overload.

2. Analysis of the used literature

The doctoral student has used specialized literary sources – a total of 129, of which 84 are in Cyrillic (Bulgarian and Russian) and 45 are in Latin (English). The majority of the literary sources have been published in the last 15-20 years. This gives reason to believe that the doctoral student is familiar with the novelties and global trends in the field of dissertation work.

3. Evaluation of the author's abstract and the author's publications related to the dissertation work

The abstract is written in accordance with the regulatory requirements and correctly reflects the structure, content and main scientific-applied and applied contributions of the dissertation work.

The dissertation work and the abstract present 5 publications of the author, 4 of which are co-authored with his scientific supervisor, and 1 is independent. The same were presented at the Energy Forum conference in 2025. They reflect the main research presented in the dissertation work. There are no publications presented that are indexed in world-renowned databases.

The publications presented, according to the minimum national criteria (Indicator G, for field of science 5), bring the author 56.66 points, which is almost twice as much as the required minimum of 30 points.

The candidate has submitted a "Report on the fulfillment of the minimum requirements for a Doctor in the relevant scientific field" in accordance with the requirements of the Bulgarian Academy of Sciences, which shows that he received 216 points with a required minimum of 200 points.

4. Evaluation of the scientific results and contributions of the dissertation work

I accept the claims for the contributions made in the dissertation work of M. Eng. Petar Petrov (5 pieces in total). In short, they can be summarized as: enrichment of existing knowledge and application of scientific achievements to increase the efficiency of electrical networks and optimize their operation under different loads.

The contributions are formulated as follows:

Scientific contributions – 2 pieces;

Scientific and applied contributions – 3 pieces.

I propose that the presented scientific contributions be reformulated into scientific and applied, and the scientific and applied ones into applied, while preserving their content.

I believe that the contributions achieved are the work of the dissertation candidate and are significant for science, as well as practically applicable in the field of electrical network optimization.

5. Critical notes and recommendations

The following more significant notes and recommendations can be made regarding the presented dissertation work and its abstract:

1. A large part of the formulas missing numbering;
2. There are no sub-figure texts for many of the figures (e.g. 1.6, 1.7, 1.10, etc.);
3. I believe that Fig. 1.1 and 1.2 are not placed in the correct place in the dissertation. They are positioned in points 4 and 5, and the commentary on them is in point 6;
4. It is not clear whether the information presented in Table 1.6 is up-to-date. It would be good to note somewhere where the data was taken from or at least indicate the date when the table was formed;
5. Too much attention has been paid to chapters 1 and 2 (about 100 pages), at the expense of the smaller volume of chapters 3 and 4 of the dissertation.

Regardless of the critical remarks and recommendations made, which are of a purely editorial nature, I would like to note the very good scientific level of the dissertation work. It is evident that the author has made efforts to conduct the individual studies and subsequently present the obtained results in an appropriate manner.

6. Conclusion and evaluation of the dissertation work

The dissertation work submitted to me for opinion contains substantiated and purposeful research and development on the formulated goal and tasks in it.

I consider that the set goal has been achieved, as I can give my **positive assessment** to the dissertation work submitted to me for opinion.

I propose to the scientific jury to award the educational and scientific degree **“Doctor”** to **M.Sc. Eng. Petar Ivanov Petrov**, in the field of sciences 5. Technical sciences, professional direction 5.2. Electrical engineering, electronics and automation, scientific specialty "Elements and devices of automation and computing technology".

22.08.2025

Member of jury:

Ruse

/Assoc. Prof. Orlin Petrov/