

DOI: <https://doi.org/10.15407/techned2020.02.003>

## TRANSIENTS AT CHANGING THE CONFIGURATION OF THE DISCHARGE CIRCUIT OF THE CAPACITOR OF SEMICONDUCTOR ELECTRICAL DISCHARGE INSTALLATIONS WITH AN ELECTRO-SPARK LOAD

Journal	Tekhnichna elektrodynamika
Publisher	Institute of Electrodynamics National Academy of Science of Ukraine
ISSN	1607-7970 (print), 2218-1903 (online)
Issue	No 2, 2020 (March/April)
Pages	3 - 9

### Authors

**N.I. Suprunovska<sup>1\*</sup>, M.A. Shcherba<sup>2\*\*</sup>, V.V. Mykhailenko<sup>2\*\*\*</sup>, Yu.V. Peretyatko<sup>2\*\*\*\*</sup>**

<sup>1</sup>-Institute of Electrodynamics National Academy of Science of Ukraine,  
Pr. Peremohy, 56, Kyiv, 03057, Ukraine,  
e-mail: [iednat1@gmail.com](mailto:iednat1@gmail.com)

<sup>2</sup>-National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute",  
Pr. Peremohy, 37, Kyiv, 03056, Ukraine,  
e-mail: [VladislavMihailenko@i.ua](mailto:VladislavMihailenko@i.ua)

\* ORCID ID : <https://orcid.org/0000-0001-7499-9142>

\*\* ORCID ID : <https://orcid.org/0000-0001-6616-4567>

\*\*\* ORCID ID : <https://orcid.org/0000-0001-6667-2457>

\*\*\*\* ORCID ID : <https://orcid.org/0000-0003-1397-8078>

### Abstract

*The method of multi-parameter functions is used in order to simplify the analysis of transients during the discharge of a capacitor to the electro-spark load in semiconductor electric discharge installations at changing the discharge circuit configuration for control the duration of the pulse currents in the load. On the basis of the analysis of transients in the discharge circuit of a variable structure of such installations, exact analytical expressions for calculating electrical characteristics of the circuit are obtained. It is determined the appropriate values of the connection moment and value of the additional inductance, which must be connected during the discharge of the capacitor to reduce the duration of discharge currents and stabilize the technological process in the electro-spark load. References 11, figures 8. tables 2.*

**Key words:** capacitor discharge, transient, electro-spark load, discharge duration, method of multi-parameter functions.

Received: 23.12.2019

Published: 26.02.2020

The work was performed at the expense of scientific work "Creation of scientific and technical bases of intellectualization of technological processes and means of measurement, control, monitoring and diagnostics in electric power and electrotechnical systems (code: INTEHEN)" within the target program of scientific researches "Fundamental Research on Energy Transformation and Utilization Processes" under the Budget Program "Supporting the Development of Priority Areas of Research" (code of programmatic classification of expenditures 6541230).

## References

1. Nguyen P.K., Lee K.H., Kim S.I., Ahn K.A., Chen L.H., Lee S.M., Chen R.K., Jin S., Berkowitz A.E. Spark Erosion: a High Production Rate Method for Producing Bi<sub>0.5</sub>Sb<sub>1.5</sub>Te<sub>3</sub> Nanoparticles With Enhanced Thermoelectric Performance. *Nanotechnology*. 2012. Vol. 23. Pp. 415604-1 – 415604-7. DOI: <https://doi.org/10.1088/0957-4484/23/41/415604>
2. Nguyen, P.K., Sungho J., Berkowitz A.E. MnBi particles with high energy density made by spark erosion. *J. Appl. Phys.* 2014. Vol. 115. No 17. Pp. 17A756-1. DOI: <https://doi.org/10.1063/1.4868330>
3. Shcherba A.A., Kosenkov V.M., Bychkov V.M. Mathematical closed model of electric and magnetic fields in the discharge chamber of an electrohydraulic installation. *Surface Engineering and Applied Electrochemistry*. 2015. Vol. 51 (6). Pp. 581-588. DOI: <https://doi.org/10.3103/S1068375515060113>
4. Vovchenko A.I., Tertilov R.V. Synthesis of nonlinear parametric capacitive energy sources for a discharge pulse technologies. *Zbirnyk naukovykh prats Natsionalnoho universytetu korablebuduvania*. 2010. No 4. Pp. 118-124. (Rus)
5. Shcherba A.A., Suprunovska N.I. Electric Energy Loss at Energy Exchange between Capacitors as Function of Their Initial Voltages and Capacitances Ratio. *Tekhnichna*

*Elektrodynamika*

2016. No 3. Pp. 9-11. DOI:

<https://doi.org/10.15407/techned2016.03.009>

6. Suprunovskaya N.I., Shcherba A.A., Ivashchenko D.S., Beletsky O.A. Processes of Energy Exchange between Nonlinear and Linear Links of Electric Equivalent Circuit of Supercapacitors.

*Tekhnichna Elektrodynamika*. 2015. No 5. Pp. 3-11. (Rus)

7. Kravchenko V.I., Petkov A.A. Parametrical synthesis of high-voltage pulse test device with capacitive energy storage. *Elektrotehnika i Elektromekhanika*. 2007. No 6. Pp. 70-75. (Rus)

8. Shcherba A.A., Podoltsev A.D., Kucheriava I.M., Ushakov V.I. Computer modeling of electrothermal processes and thermomechanical stress at induction heating of moving copper ingots. *Tekhnichna Elektrodynamika*. 2013. No 2. Pp. 10-18. (Rus)

9. Ivashchenko D.S., Shcherba A.A., Suprunovska N.I. Analyzing Probabilistic Properties of Electrical Characteristics in the Circuits Containing Stochastic Load. Proc. *IEEE International Conference on Intelligent Energy and Power Systems IEPS-2016*.

Kyiv, Ukraine, June 7–11, 2016. Pp. 45-48. DOI:

<https://doi.org/10.1109/IEPS.2016.7521887>

10. Livshits A.L., Otto M.Sh. Pulse electrical engineering. Moscow: Energoatomizdat, 1983. 352 p. (Rus)

11. Makarenko M.P., Senko V.I., Yurchenko M.M. System analysis of electromagnetic processes in the electric power semiconductor converters of modulation type. Kyiv: Institute of Electrodynamics of NAS of Ukraine, 2005. 241 p. (Ukr)

[PDF](#)



This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/)