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TRANSIENT ANALYSIS IN CIRCUITS OF ELECTRIC DISCHARGE INSTALLATIONS WITH VOLTAGE FEEDBACK TAKING INTO ACCOUNT THE RECOVERY TIME OF LOCKING PROPERTIES THEIR SEMICONDUCTOR SWITCHES

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Abstract

The paper substantiates the approach to the selection of the inductance value of the choke in the reverse-recharge circuit of a capacitor of thyristor electric discharge installations with controlled voltage feedback (in particular, installations for volumetric electro-spark dispersion of metals in a liquid). The approach is based on taking into account the recovery time of the locking properties of the thyristor in the discharge circuit of such installations, as well as the

permissible losses in the reverse-recharge circuit of a capacitor. The results of mathematical modeling of the transient processes in the capacitor circuits of such installations have shown that if the choke inductance is correctly selected in the reverse-recharge circuit of a capacitor, then it is possible to switch on this circuit before the end of the discharge process of the capacitor to the load (i.e., when the capacitor discharge circuit change its configuration during capacitor discharge). In this case, the losses in the reverse-recharge of the capacitor will not exceed 10% of the energy stored in the capacitor before the recharge start. References 10, figures 5, tables 2.

Key words: transients, capacitor discharge, reverse recharge, thyristor recovery time.

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References

1. Livshitz A.L., Otto M.Sh. Pulse electrotechnology. Moskva: Energoatomizdat, 1983. 352 p. (Rus)
2. Mysinski W. Power supply unit for an electric discharge machine. Proc. 13th European Conference on *Power Electronics and Applications EPE'09*. Poznan, Poland, September 01-03, 2009. P. 1–7. DOI: <https://doi.org/10.1109/EPEPEMC.2008.4635451>
3. Pentegov I.V. Basis of charging circuits of capacitive energy storage. Kyiv: Naukova dumka, 1982. 424 p. (Rus)
4. Sen B., Kiyawat N., Singh P.K., Mitra S., Ye J.H., Purkait P. Developments in electric power supply configurations for electrical-discharge-machining (EDM). Proc. 5th International Conference on *Power Electronics and Drive Systems PEDS2003*. Singapore, 17-20 November 2003. Vol. 1. P. 659–664. DOI: <https://doi.org/10.1109/PEDS.2003.1282955>
5. Shidlovskii A.K., Shcherba A.A., Suprunovska N.I. Power processes in the electropulse installations with capacitive energy storages. Kiev: Intercontinental-Ukraine, 2009. 208 p. (Rus)

6. Suprunovska N.I., Shcherba A.A., Ivashchenko D.S. Processes of energy exchange between nonlinear and linear links of electric equivalent circuit of supercapacitors. *Tekhnichna Elektrodynamika*. 2015. No 5. P. 3–11. (Rus)
7. Shcherba A.A., Suprunovska N.I., Ivashchenko D.S. Modeling of nonlinear resistance of electro-spark load taking in to account its changes during discharge current flowing in the load and at zero current in it. *Tekhnichna Elektrodynamika*. 2014. No 5. P. 23–25. (Rus)
8. Kravchenko V.I., Petkov A.A. Parametrical synthesis of high-voltage pulse test device with capacitive energy storage. *Electrical engineering & Electromechanics*. 2007. No 6. P. 70–75. (Rus)
9. Vovchenko A.I., Tertilov R.V. Synthesis of capacitive non-linear- parametrical energy sources for discharge-pulse technologies. *Zbirnyk naukovykh pratz Natsionalnoho universytetu korablebuduvannia*. 2010. No 4. P. 118–124. (Rus)
10. Grigorev O.P., Zamiatin V.Ia., Kondratev B.V., Pozhidaiev S.L. Thyrystors: handbook. Moskva: Radio i sviaz, 1990. 272 p. (Rus)

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