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CHARGE-TRANSFER BASED SENSORLESS VOLTAGE FEEDBACK IN HV CAPACITOR CHARGERS

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Rapid capacitor chargers are typically used to charge a bank of capacitors with the purpose of discharging it into a pulsed power load [1,3]. Previous research shows that the charging voltage of the load can be accurately calculated in real-time using microcontroller software algorithms [2]. The objective of this paper is to report a hardware based approach to measure the charge transfer into the load capacitor and implicitly the capacitor charging voltage. The proposed circuit uses operational amplifiers in order to integrate the input charge. A microcontroller receives the integrated signal to compute the output voltage and stop the charging process when the target voltage has been reached. Failure to accurately detect the end of charge time could lead to an excessively large capacitor bank voltage. For this reason, the proposed method can be utilized as a backup for end of charge detection. A comparison is performed between the proposed mechanism and the method described in [1].

1. Giesselmann, M.G.; Bilbao, A., "Digital control of a rapid capacitor charger with sensor-less voltage feedback" in Dielectrics and Electrical Insulation, IEEE Transactions on , vol.22, no.4, pp.1930-1936, August 2015.
2. Michael G Giesselmann, Travis T Vollmer, William J Carey, "100-kV High Voltage Power Supply with Bipolar Voltage Output and Adaptive Digital Control", IEEE Transactions on Plasma Science, Volume: 42, Issue: 10, June 2014.
3. Travis T Vollmer, Michael G Giesselmann, "Rapid capacitor charging power supply for an 1800J PFN", Proceedings of the 2012 IEEE International Power Modulator and High Voltage Conference (IPMHVC), San Diego, CA, USA, June 2012.

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