PULSE TRANSFORMER FOR NON-THERMAL GASEOUS DISCHARGES IN ATMOSPHERIC PRESSURE

Pedro Y. B. Marquezini, Milton E. Kayama, Diego A. Reis and André B. Laraia
Universidade Estadual Paulista - Faculdade de Engenharia do Campus de Guaratinguetá

1. Introduction

Gaseous discharges at atmospheric pressure have been investigated for applications in several áreas of engineering and medicine. The voltage required to produce these discharges depends of the product *pd* , where *p* is the gas pressure and *d* the distance between the electrodes. At atmospheric pressure and distances of millimeters the voltage required is up to 40 kV. In order to promote such discharges we developed voltage multiplier based in pulse transformers operating in cascade [1]. In present work we describe the theoretical model and the characteristics of the transformer.

2. Experiment

The experiment was carried out with pulse transformers in cascade. The transformer was wired with either Litz or regular cable in ferrite core with initial permeability 2200, flux density 0.42 mT@795.8 A/m, outer diameter 87 mm inner and diameter 50 mm. The drawing of the transformer is shown in Fig. 1.a. Three independent coils were mounted around central core at ratio 1:40:1 the most inner one used as primary winding. The response of the transformer for various frequency was studied using sinusoidal function generator feeding the primary circuit. A theoretical model for the pulse transformers was created allowing simulate the operation in the frequency up to 100 kHz. The partial diagram of simulation with the transfer function is shown in Fig. 1.b.

3. Results and discussions

The Figure 2 shows the behavior of the output voltage in the secondary of the transformer for various load resistances. It has a flat response for frequency in the range of 10 kHz up to 1 MHz. The simulation reproduces this behavior that extends for wide range of frequency. In spite of close description in the response of actual transformer the model is been improved combining new stray elements.

4. Conclusion

The preliminary results indicated that the transformer is reliable to operate as voltage multiplier in the range of frequency used to generate plasmas through gaseous discharges at atmospheric pressure.

This work was supported by FAPESP, CNPq and CAPES.

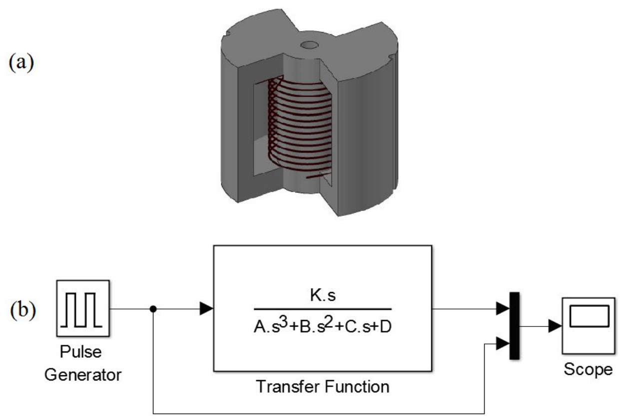

Fig.1 – (a)Drawing of the pulse transformer and (b) diagram of simulation circuit.

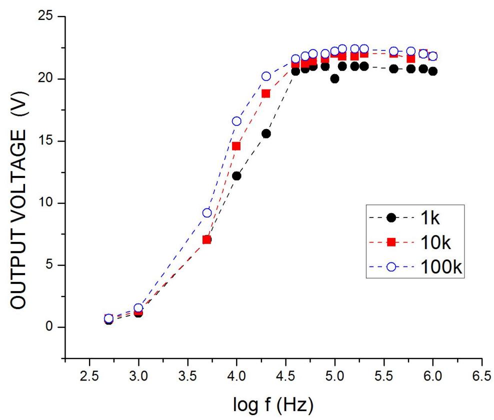

Fig.2 – Frequency response of the pulse transformer.

References

[1] Train, D. and Vohl, P.E., Determination of Ratio Characteristics of Cascade Connected Transformers, IEEE Trans. Power App. Syst., vol. PAS-95(6), 1976