

Effect of the Electrode Geometry on the Radiation Performance of a High-Power Dipole Antenna

A. Alebri⁽¹⁾, A. Al Ali⁽¹⁾, H. AlHamaadi⁽¹⁾,
H. Alyahyaee⁽¹⁾, M. Almenhali⁽¹⁾, M. Al Yousef⁽¹⁾,
M. Al Kaabi⁽¹⁾, Y. Al Nuaimi⁽¹⁾, H. Al Ketbi⁽¹⁾,
S. Al Dahmani⁽¹⁾, F. Vega⁽¹⁾, C. Kasmi⁽¹⁾

(1) Direct Energy Research Center, Technology Innovation
Institute, Abu Dhabi, United Arab Emirates

Ahmed.ALEbri@tii.ae

Abstract—This paper studies the influence of the geometry of the electrodes of the spark gap used in a dipole antenna for high-power UWB applications. The efficiency of radiation is illustrated through simulations and experiments.

Keywords: Hertz Antenna, Spherical electrodes, Rogowski electrodes, Flat electrodes, Bruce electrodes, Hemisphere electrodes, EM Radiation.

I. INTRODUCTION

Dipole antennas have been proposed as a source of electromagnetic radiation in High Power applications [1], [2]. The radiator consists of a pressurized spark gap, fed by a pulsed high voltage source. The electrodes of the spark gap connected to the arms of a dipole, as illustrated in Figure 1.

The electrodes of the spark gap are, generally, designed taking into consideration the electric field distribution in electrostatic conditions. However, little attention has been given to the effect that the shape of the electrode has on the radiated signal, i.e. initial risetime, bandwidth, etc.

In this paper we'll study the field radiated by a normalized dipole under different spark gap electrodes, namely: Bruce, Rogowski, Flat, Hemisphere and Spherical. See Figure 2 for illustration.

II. Experimental Setup & Simulation

The simulation setup consists of a set of three dipole antennas with different length to diameter ratio. For each one, five different electrodes have been designed. The gap distance L_2 is held constant in all the cases. The spark gap was excited using double exponential signal from a HV pulser at constant rise/fall time and peak voltage. See Figure 3 for illustration.

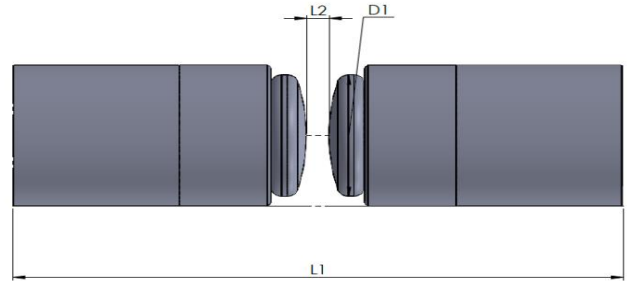


Figure 1 Electrodes of a spark gap connected to the arms of a dipole

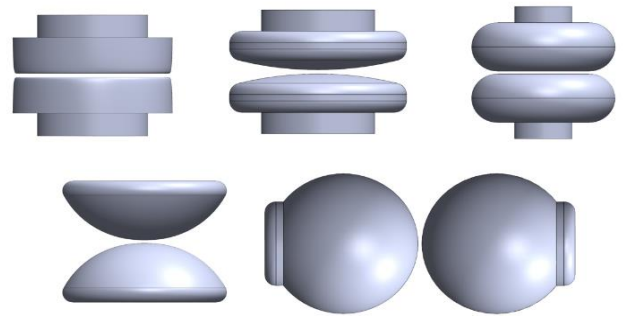


Figure 2 Electrodes shapes: Rogowski electrodes, Bruce electrodes, Flat electrodes, Hemisphere electrodes, Spherical electrodes respectively.

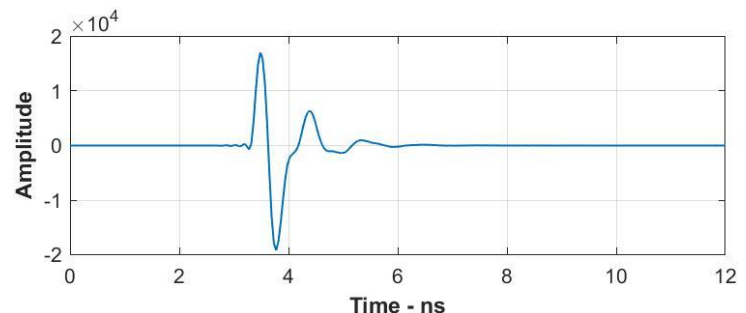


Figure 3 Example of the radiated electric field, normalized at 1(m). The peak voltage at the excitation is 50kV, the rise time is 500 ps-

REFERENCES

- [1] J. Ryu, J. Lee, H. Chin, J. Yeom, H. Kim, H. Kwon, S. Han and J. Choi, "A high Directive Paraboloidal Reflector Antenna for High far Voltage in an Ultra Wideband Source System," *IEEE Trans. Plasma Sci.*, vol. 41, no. 8, Aug. 2013.
- [2] J. Ryu and J. Lee, "An integrated antenna-source system of very high ultra wide-band gain for radiating high power wide-band pulses," *IEEE Trans. Plasma Sci.*, vol. 40, no. 4, Apr. 2011.