ON THE RESONANCE LENGTHS FOR CENTER FED DIPOLES USING THE METHOD OF MOMENTS WITH DIFFERENT SOURCE MODELS

H.M. Elkamchouchi and M. Elrakiaby
Department of Electrical Engineering, Faculty of Engineering,
Alexandria University, Alexandria, Egypt.

ABSTRACT

Different source models and practical dipole thickness are used to obtain the resonance lengths and input resistance for center-fed dipoles by the method of moments (MoM). The Guassian function, frill generator and unit step source models are used.

Keywords: The method of moments, The electromotive force. Thick dipole antennas.

INTRODUCTION

1- MODEL ANALYSIS

The resonance length of the dipole and the associated input resistance are important parameters used in the design consideration of VHF and UHF antennas. The method of moments(MoM) using accurate current distribution with practical dipole thickness is considered for the calculation of the resonance dipole length and the associated input resistance. This is achieved using three source models, namely, the guassian function [1], frill generator and unit step [2] source models. The generalized voltage matrix is evaluated for each model. Pulse expansion functions and point matching are used in the calculations. The number of segments is chosen to be 63. In the guassian function source model, the electric field on the axis of the dipole is given by

$$E(z) = \frac{1}{\sqrt{2\pi\delta^2}} e^{-z^2/2\delta^2} \qquad (1)$$

Where $\delta = a/2$, and a is the radius of the dipole and the z axis is along the axis of the dipole with origin at the feeding point. For the frill generator model

$$E(z) = \frac{1}{2\ln(b/a)} \left[\frac{e^{-j2\pi R_1/\lambda}}{R_1} - \frac{e^{-j2\pi R_2/\lambda}}{R_2} \right] \qquad (2)$$

Where $R_1 = \sqrt{z^2+a^2}, R_2 = \sqrt{z^2+b^2}$

and b is the frill magnetic current radius. The ratio b/a is chosen to be 2.23. For the calculations of the input impedance using a unit step source model, the dipole is divided into two segments and a third degree polynomial is used to approximate the current distribution along each segment

2- RESULTS

The resultant resonance lengths are indicated in Figure (1) with the EMF results [3] for comparison. The value of the input reactance is less than 0.2 Ohms in these calculations. Figure (2) shows the input resistance for each resonance length. In these results the capacitance of the feeding gap and the charge on the two plane circular ends are neglected.

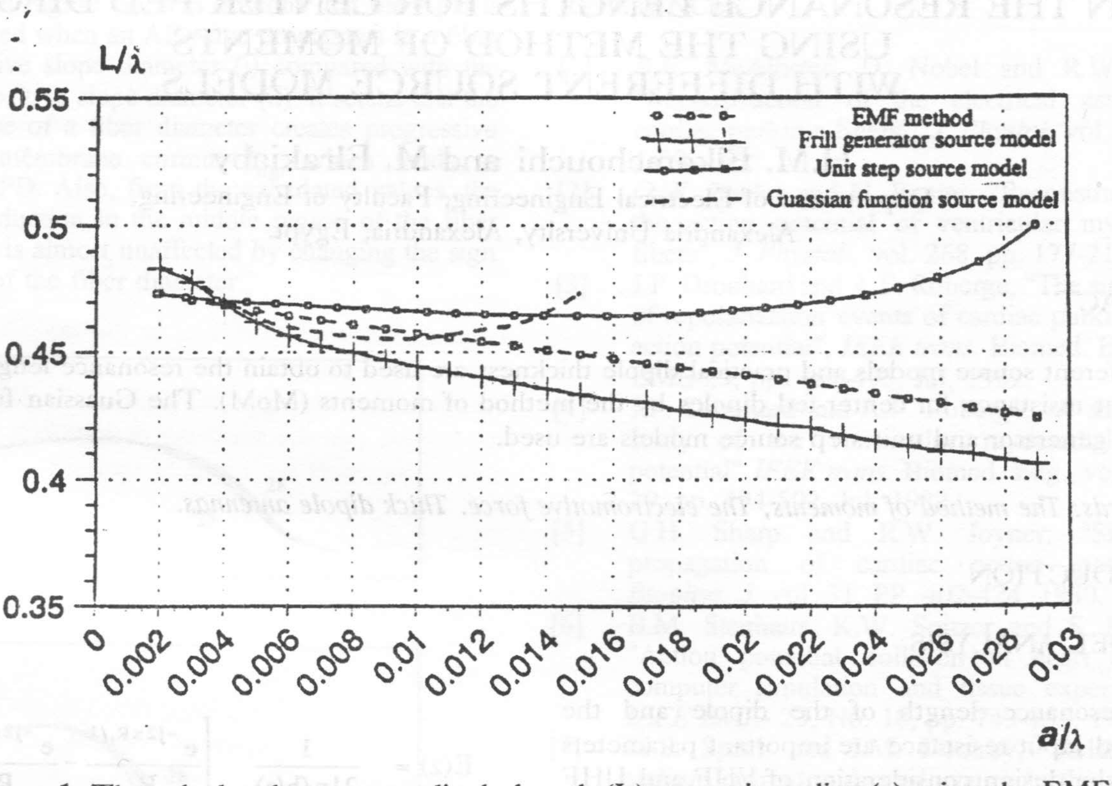

Figure 1. The calculated resonance dipole length (L) versus its radius (a) using the EMF and MoM for different source models.

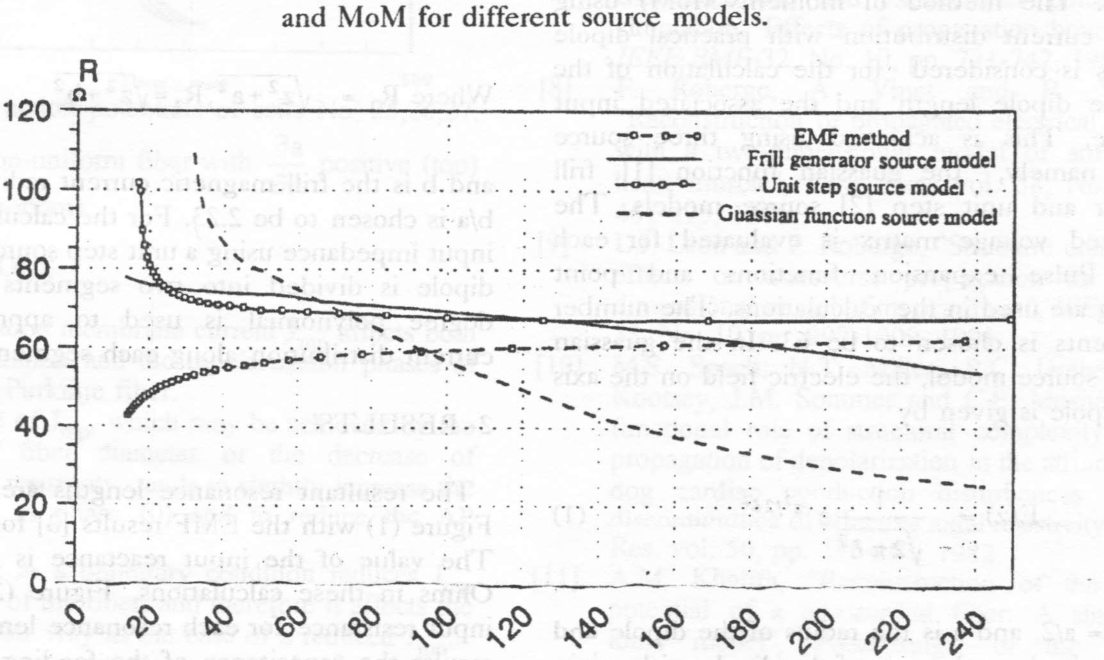

Figure 2. The resonance input resistance versus resonance L/a using the EMF and MoM for different source models.

3. CONCLUSIONS

The obtained results give good reference for the determination of the dipole length and its input resistance for a given radius and operating frequency. Although the Guassian source model, resulted in improving the calculations for thin dipoles, it gives no definite resonance lengths for thick dipoles.

REFERENCES

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