CHAPTER I

INTRODUCTION

The primary purpose of an antenna is to provide suitably localized and oriented paths for oscillating electric currents. The distribution in amplitude and phase of accelerated charges moving along the antenna's paths determine not only the impedance but also all the characteristics of its electromagnetic field, including the directional properties of the antenna.

In the late 1920, no attempt was made to determine the actual distributions of current along the antenna. Instead a convenient sinusoidal distribution was assumed and the electromagnetic field is conveniently determined from Maxwell's equations. The resulting expressions were first obtained for the half wave dipole by P.S. Carter (1) in 1932 and for the antenna of arbitary length by G.H. Brown (2) in 1937.

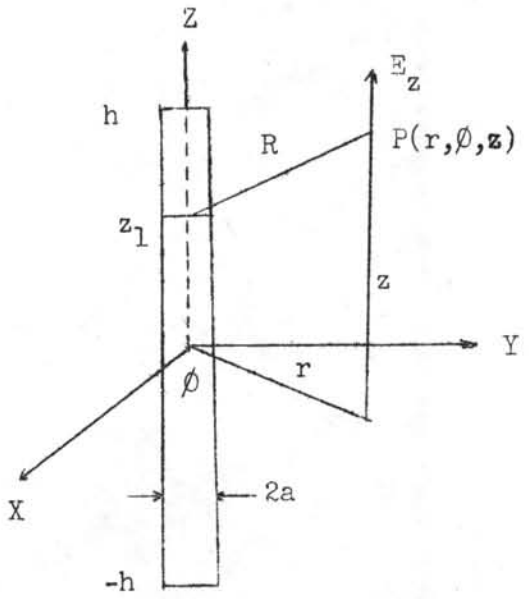

Fig. 1.1 The cylindrical antenna and its cylindrical coordinates

The fields determined by Carter and Brown, did not consider about the radius of the cylindrical antenna, with the maximum value at r = 0 (in Fig. 1.1) and decreases slowly as r is increased. It followed that the boundary condition $E_z = 0$ on the surface (r = a) of a perfect conducting cylindrical antenna couldnot be satisfied and the current distribution was also assumed to be sinusoidal.

The correct method for determining the properties of a center-driven cylindrical antenna is to determine the actual distribution of current which generates the electromagetic field that satisfies the boundary condition: $E_z = 0$, at r = a,

In order to approach the problem, it is assumed that the conducting cylinder is center-driven by the discontinuity scalar potential $\phi(z)$

Hence terminal voltage $$V = \lim_{z \to 0} [\phi(z) - \phi(-z)] \qquad (1)$$

Following Maxwell's equations, electric field becomes

$$\bar{E} = -j \frac{w}{k^2}(\nabla(\nabla.\bar{A}) + \bar{A}) \qquad (2)$$

The current distribution can be obtained from eq. (2) and its approximate solution has been obtained by many authors beginning with L.V. King (3), Hallen (4), and K.K Mei (5).

The study and investigation of the characteristic of stacked cylincrical antennas must be started from the characteristics of cylindrical stub antenna. In this thesis, the thick cylindrical stub antenna for which the current distribution is not sinusoidal is considered and the numerical values of its impedance are calculated. The method of consideration is based on boundary-value problems and on some considerations of the antenna conductivity. The impedance of stack cylindrical antenna will not be considered theoretically in this thesis because there is not any complete satisfactory method of calculating mutual effect in general. Besides its approximate solution is also too complicated. Therefore the investigation is merely done by experiments.

The field patterns of a two-element stacked cylindrical antennas are considered by using a well-known "Law of Multiplication" and based on the thesis titled "The Field Pattern and Gain Analysis of a Hollow Cylindrical Antenna." which is written by Mr. Pakorn Borimasporn (6).

The results obtained in this thesis will be useful for working with any thick cylindrical antenna and may be served as a potential guidance for future study.