FOURTH ORDER EQUATION OF THE ELECTRIC CIRCUIT

LET R SERIES RESISTANCE

G SHUNT CONDUCTANCE

X SERIES REACTANCE

B SHUNT SUCEPTANCE

$\dot{Z}$ TOTAL COMPLEX SERIES IMPEDANCE

$\dot{Y}$ TOTAL SHUNT CONDUCTANCE

OHM $\dot{Z} = (k_4^0 R + k_4^1 X) + (k_4^2 G + k_4^3 B)$

SIEM $\dot{Y} = (k_4^0 G + k_4^1 B) + (k_4^2 R + k_4^3 X)$

CHARACTERISTIC IMPEDANCE

$$\dot{Z}_0 = \sqrt{\frac{\dot{Z}}{\dot{Y}}} \quad \text{OHMS}$$

PROPAGATION CONSTANT

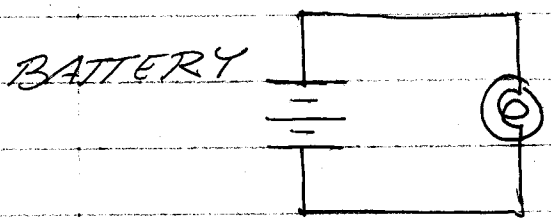
$$\gamma_0 = \sqrt{\dot{Z}\dot{Y}} \quad \text{NEPER} \cdot \text{RADIANS}$$

DIFFERENTIAL OPERATOR

$$k_4^n = +1^{+\frac{1}{4}} = \sqrt[4]{+1}$$

$$k_4^0 = 1, \quad k_4^1 = j, \quad k_4^2 = -1, \quad k_4^3 = -j$$

SIMPLE EXAMPLE, A FLASHLITE:



$E = 1$ VOLT

$I = \frac{1}{2}$ AMP

(I) BATTERY, PRODUCING ENERGY

1) AT THE RATE $E \cdot I = 0.5$ WATT

2) WITH NEGATIVE CONDUCTANCE $-G =$ -0.5 SIEMENS

(II) LAMP, CONSUMING ENERGY

1) AT THE RATE $E \cdot I = -0.5$ WATT

2) WITH A POSITIVE RESISTANCE $+R =$ $+2.0$ OHM

(III) CHARACTERISTIC IMPEADANCE OF FLASHLITE

$$Z_0 = \sqrt{R/G} = \sqrt{2/0.5} = 2 \text{ OHM}$$

(IV) CHARACTERIC PROPAGATION OF FLASHLITE

$$\gamma_0 = \sqrt{RG} = \sqrt{2 \times 0.5} = 1 \text{ NEPER}$$

(V) FLASHLITE IS SCALAR IN THAT NO VARIATION WITH RESPECT TO LENGTH NOR VARIATION WITH RESPECT TO TIME OF THE QUANTITIES E, VOLTS & I, AMPERES

REF 1) SYMBOLIC REP. OF ALTERNATING ELECTRIC WAVE, E.P. DOLLARD.
REF 2) SYMBOLIC REP. OF GENERALIZED ELECTRIC WAVE, E.P. DOLLARD.

REPRESENTING ENERGY RETURN & STORAGE.

TABLE (2)

$+1k_4^1 = +j$	$+1k_4^{-1} = 1k_4^3 = -j$
$+1k_4^2 = -1$	$+1k_4^{-2} = 1k_4^2 = -1$
$+1k_4^3 = -j$	$+1k_4^{-3} = 1k_4^1 = +j$
$+1k_4^4 = +1$	$+1k_4^{-4} = 1k_4^0 = +1$
$-1k_4^1 = -j$	$+1k_4^{-1} = 1k_4^1 = +j$
$-1k_4^2 = +1$	$-1k_4^{-2} = 1k_4^0 = +1$
$-1k_4^3 = +j$	$-1k_4^{-3} = 1k_4^3 = -j$
$-1k_4^4 = -1$	$-1k_4^{-4} = 1k_4^2 = -1$
FORWARD ROTATION	REVERSE ROTATION