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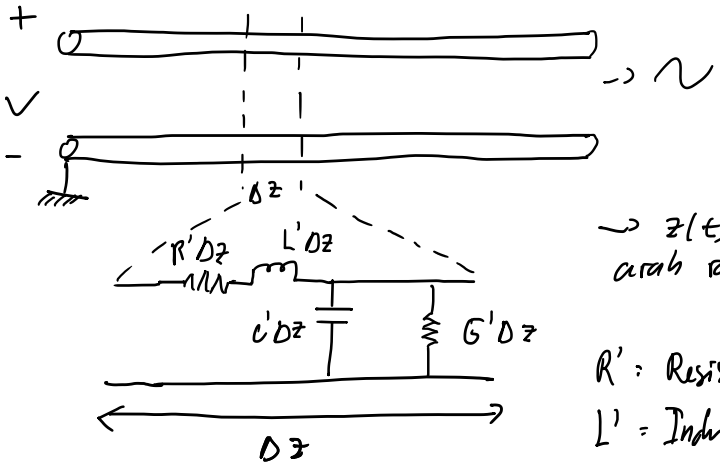
Saluran Transmisi

Sumber



→ z(t)
arah rambat gelombang

R' : Resistansi / panjang (Ω/m)
L' : Induktansi / panjang (H/m)
C' : kapasitansi / panjang (F/m)

Konstanta Primer :
R', G', L', C' → bergantung bahan (ε_r, μ_r, σ), frekuensi, dimensi fisik

Konstanta sekunder :
γ : konstanta propagasi

$$\gamma = \sqrt{(R' + j\omega L')(G' + j\omega C')}$$

$$= \alpha' + j\beta'$$

α' : konstanta redaman (Nepers/m)
β' : konstanta phasa (rad/m)

2 Fenomena → * Atenuasi (redaman) : R' & G'
R' ≃ redaman pada konduktansi
G ≃ redaman pada dielektrik
* Pergeseran phasa (delay) : C' & L'

Gel. Datar Serbasama	Saluran Transmisi
σ (℧/m, S/m) ε_r μ_r ---	G' (℧/m) C' (F/m) L' (H/m) R' (Ω/m)
$\gamma = \sqrt{j\omega\mu_r\mu_0(\sigma + j\omega\varepsilon_r\varepsilon_0)}$	$\gamma = \sqrt{(R' + j\omega L')(G' + j\omega C')}$
$\eta = \sqrt{\frac{j\omega\mu_r\mu_0}{\sigma + j\omega\varepsilon_r\varepsilon_0}}$	Z_0 : Impedansi karakteristik $Z_0 = \sqrt{\frac{R' + j\omega L'}{G' + j\omega C'}}$ Ω
$\vec{E}(z) = E_0 e^{-\gamma z}\hat{a}_x$ $= E_0 e^{-\alpha z} e^{-j\beta z}\hat{a}_x$ $\vec{E}(z,t) = E_0 e^{-\alpha z}\cos(\omega t - \beta z)\hat{a}_x$	$V(z) = V_0 e^{-\gamma z}$ $= V_0 e^{-\alpha' z} e^{-\beta' z}$ $V(z,t) = V_0 e^{-\alpha' z}\cos(\omega t - \beta' z)$
$H(t) = \frac{E_0}{\eta} e^{-\gamma z}\hat{a}_y$ $= \frac{E_0}{\eta} e^{-\alpha z} e^{-j\beta z}\hat{a}_y$ $H(z,t) = \frac{E_0}{\eta} e^{-\alpha z}\cos(\omega t - \beta z)\hat{a}_y$	$I(z) = \frac{V_0}{Z_0} e^{-\gamma z}$ $= \frac{V_0}{Z_0} e^{-\alpha' z} e^{-j\beta' z}$ $I(z,t) = \frac{V_0}{Z_0} e^{-\alpha' z}\cos(\omega t - \beta' z)$

* Lossless line (Tanpa redaman)

$R' = 0$, $G' = 0$ $\}$ $\gamma = j\beta'$ $\rightarrow$ $\beta' = \omega\sqrt{L'C'} = 2\pi f\sqrt{L'C'}$

* Lossless line

$R' << j\omega L'$

$G' << j\omega C'$

* Distortionless

~ Tanpa distorsi

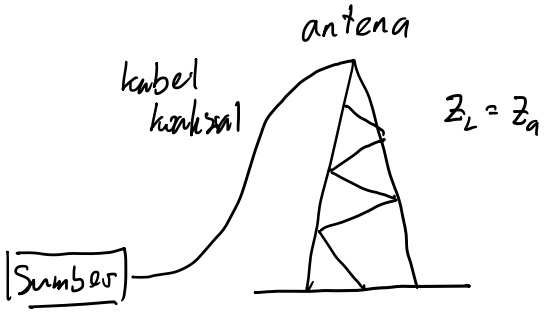
~ Distorsi

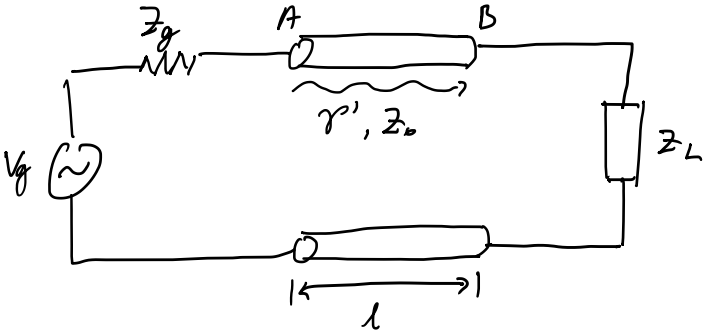
$\omega L' << R'$

$\omega C' << G'$

Skematik diagram

1.





2. Sumber — kabel — Penerima

$Z_L = Z_{penerima}$

V_g : Tegangan generator

Z_g : Impedansi generator

$Z_L = Z_0$ (match)

$$\frac{V(z_1)}{I(z_1)} = \frac{V(z_2)}{I(z_2)} = \frac{V(z_n)}{I(z_n)} = Z_0$$

$Z_L \neq Z_0$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0}$$

$$\Gamma = \frac{\eta_2 - \eta_1}{\eta_2 + \eta_1}$$

Sinyal datang (V^+, I^+, P^+)

Sinyal pantul (V^-, I^-, P^-)

$$\Gamma = \frac{V^-}{V^+} \rightarrow \frac{P^-}{P^+} = \Gamma_L^2$$

$Z_L = \infty$

$\Gamma_L = 1 \rightarrow V^- = V^+$