Unit-V

Travelling Wave

Effects of Line Termination

- Assuming vf, if,vb and ib are the instantaneous voltage and current.

  Hence the instantaneous voltage and current at the point discontinuity are :
- $v(x,t)=v_f + v_b$ and $I(x,t)=I_f + I_b$

Effects of Line Termination

- $I = v_f/Z_c - v_b/Z_c$
  and $iZ_c = v_f - v_b$

- $v + iZ_c = 2v_f$
  so $v = 2v_f = iZ_c$

- $v_f = ½ (v + iZ_c)$
  and $v_b = ½ (v + iZ_c)$
  or $v_b = v_f - iZ_c$

Line Termination in Resistance

$$v = iR$$

$$i = \frac{2}{R + Z_c} v_f$$

$$v_f = \frac{R + Z_c}{2R}$$

$$v_b = \frac{R - Z_c}{R + Z_c} v_f$$

Line Termination in Resistance

$$P_f = \frac{v_f^2}{Z_c}$$

$$P_b = \frac{v_b^2}{Z_c}$$

$$P_R = \frac{v^2}{R} = \frac{\left(v_f + v_b\right)^2}{R}$$

$$P_f = P_b + P_R$$

Line Termination in Impedance (Z)

$$i = \frac{2}{Z + Z_c} i_f$$

$$v = \frac{2Z}{Z + Z_c} v_f$$

$$v = \tau v_f$$

$$\tau \cong \frac{2Z}{Z + Z_c}$$

Line Termination in Impedance (Z)

$$v_f = \frac{Z + Z_c}{2R} v$$

$$v_b = \frac{Z - Z_c}{Z + Z_c} v_f$$

$$v_b = \rho v_f$$

$$\rho \cong \frac{Z - Z_c}{Z + Z_c}$$

- Line is terminated with its characteristic impedance :
  - $Z=Z_c$
  - ρ =0, no reflection (infinitely long)

- $Z>Z_c$
  - v_b is positive
  - I_b is negative
  - Reflected surges increased voltage and reduced current

- $Z<Z_c$
  - v_b is negative
  - I_b is positive
  - Reflected surges reduced voltage and increased current

- Z_s and Z_R are defined as the sending-end and receiving end.

$$\rho_s = \frac{Z_s - Z_c}{Z_s + Z_c} ; \rho_R = \frac{Z_R - Z_c}{Z_R + Z_c}$$

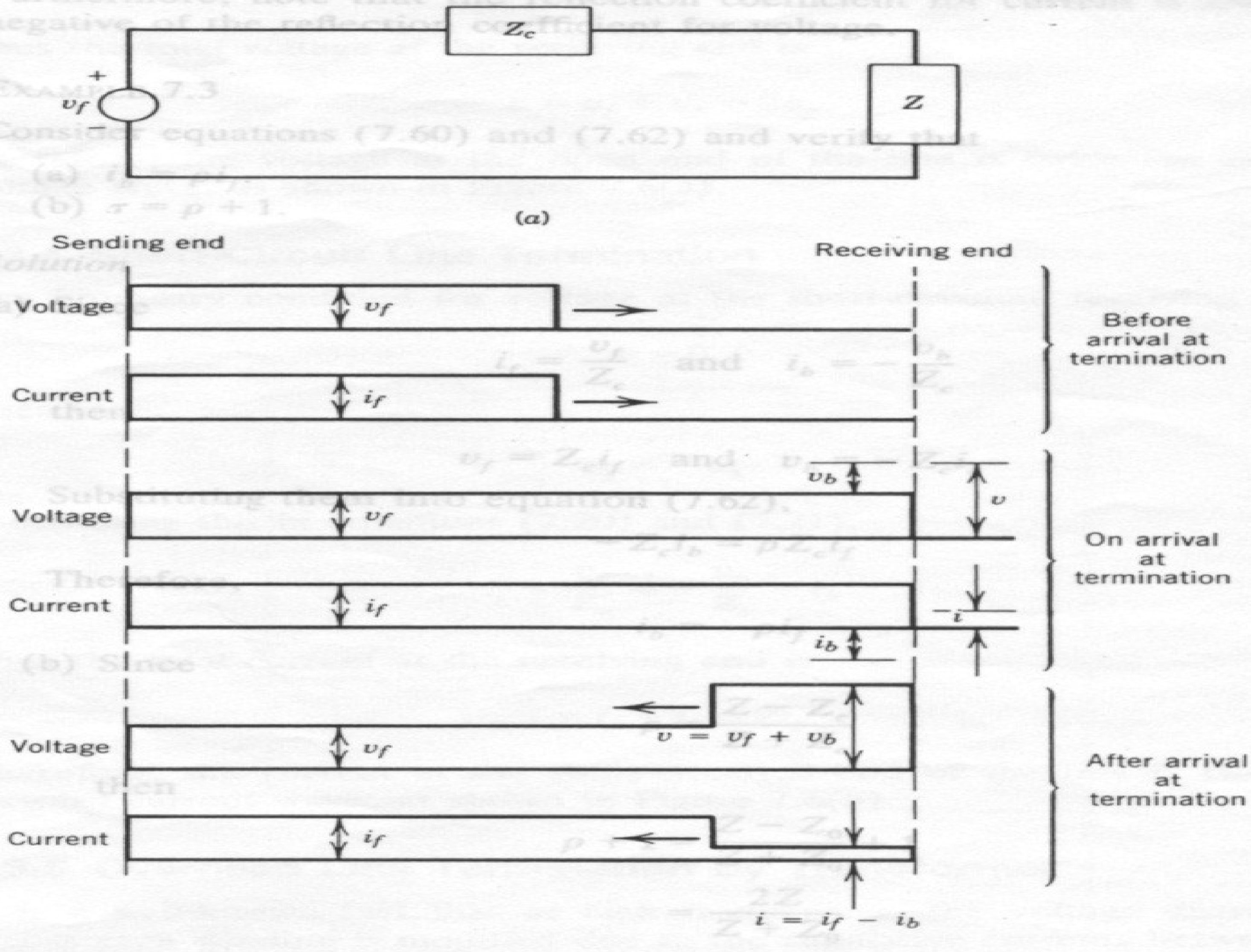

Figure 7.4. Analysis of traveling waves when $Z > Z_c$: (a) circuit diagram; (b) voltage and current distributions.

$$\rho_s = \frac{Z_s - Z_c}{Z_s + Z_c} \qquad (7.65)$$

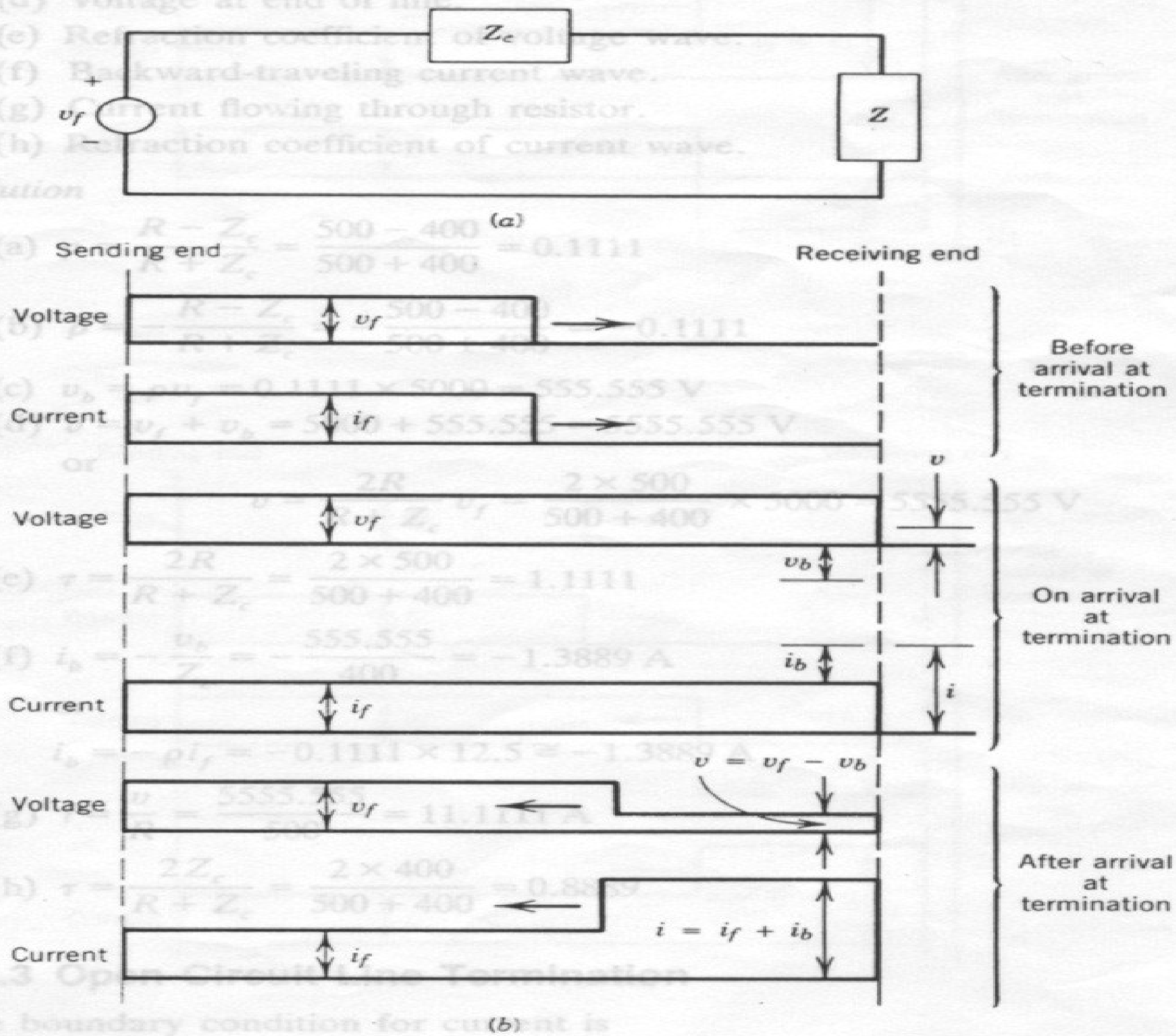

Figure 7.5. Analysis of traveling waves when $Z < Z_c$: (*a*) circuit diagram; (*b*) voltage and current distributions.

Thanks