

EE 3113

INTRODUCTION INTO RF

CIRCUIT DESIGN

Lecture Notes for A-term 1999

LECTURE 6

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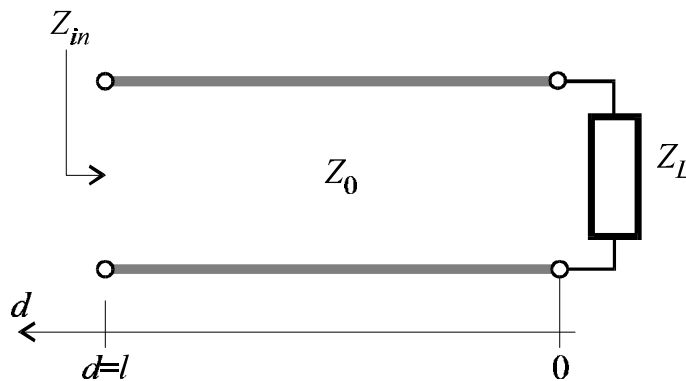
Worcester, MA 01609

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Special Termination Conditions

- Lossless transmission line

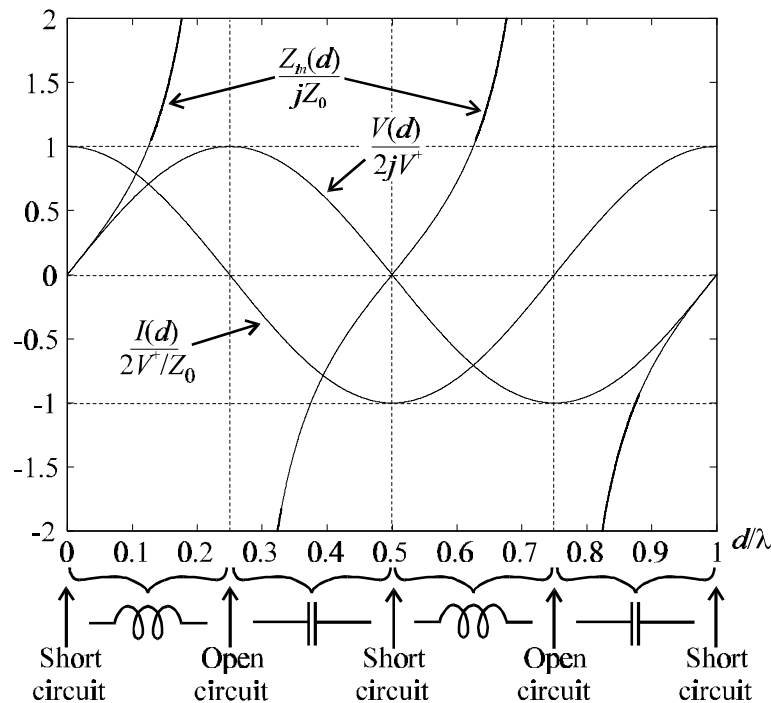
$$Z_{in}(d) = Z_0 \frac{Z_L + jZ_0 \tan(bd)}{Z_0 + jZ_L \tan(bd)}$$



Characteristic impedance

$$Z_0 = \sqrt{\frac{L}{C}}$$

Input impedance of short circuit transmission line



Voltage:

$$V(d) = 2jV^+ \sin(bd)$$

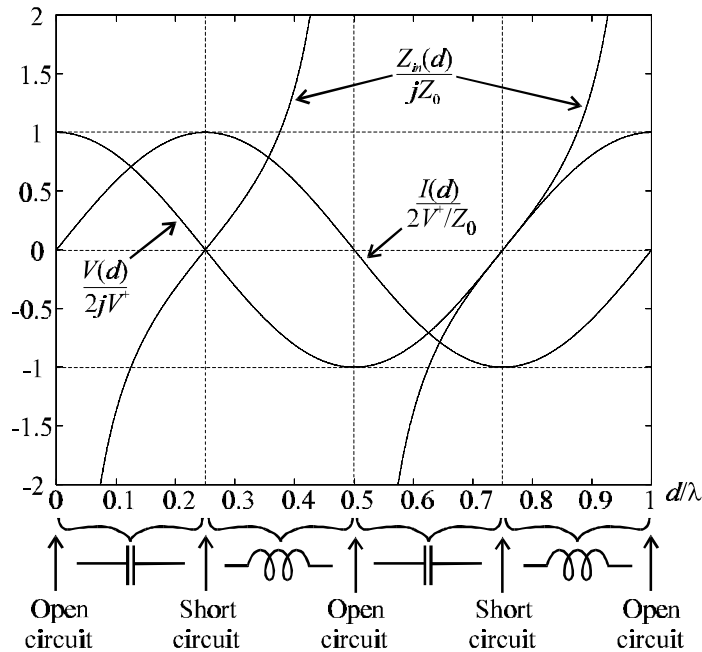
Current:

$$I(d) = \frac{2V^+}{Z_0} \cos(bd)$$

Impedance

$$Z_{in}(d) = jZ_0 \tan(bd)$$

Input impedance of open circuit transmission line



Voltage:

$$V(d) = 2V^+ \cos(bd)$$

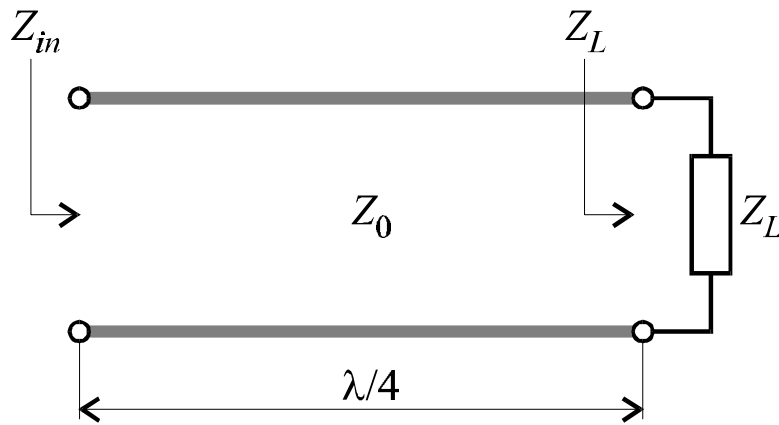
Current:

$$I(d) = \frac{2jV^+}{Z_0} \sin(bd)$$

Impedance

$$Z_{in}(d) = -jZ_0 \cot(bd)$$

Quarter-wave transmission line



$$Z_{in}(l/4) = Z_0 \frac{Z_L + jZ_0 \tan(bl/4)}{Z_0 + jZ_L \tan(bl/4)} = \frac{Z_0^2}{Z_L}$$

Quarter-wave transformer model:
given input and output impedances

Predict line
impedance

$$Z_0 = \sqrt{Z_L Z_{in}}$$

What should you know?

- Input impedance: Page 80, equation (2.71)
- Example 2.6 on page 82
- Example 2.7 on page 84
- Example 2.8 on page 87

Matching works only for particular frequencies

