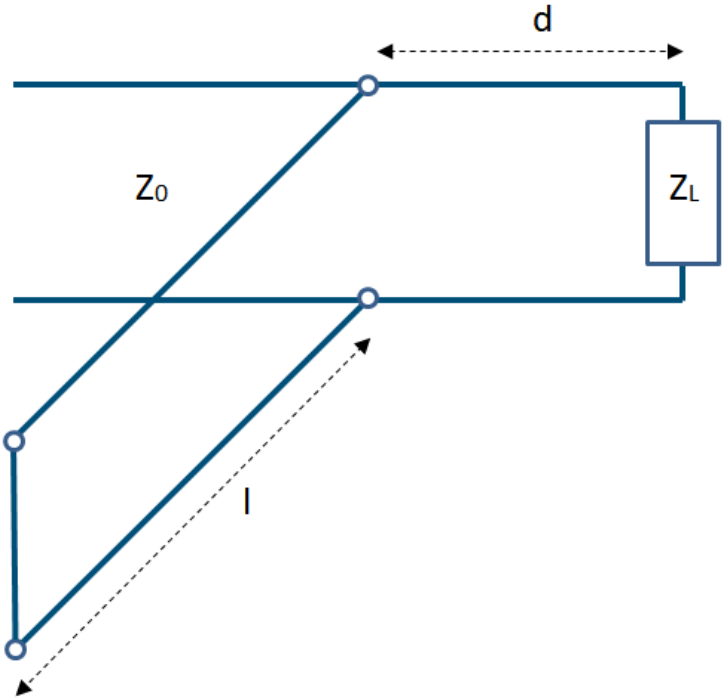
Single Stub Matching of a Transmission Line

Introduction

A single short circuited transmission line is a distance d from the load and of length d.



Given a characteristic impedance of Z_0 and a load with complex impedance Z_L, this application will calculate the values of d and l.

- The real part of the impedance at the stub location must match the transmission line characteristic impedance
- The imaginary part of the impedance at the stub location must equal 0

Reference:
Iskander, Magdi F., Electromagnetic Fields and Waves, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1992.

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> restart :
  assume( d, real, l, real )
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Parameters

Resistances

> $Z_0 := 50\ \text{ohms}$:

> $Z_L := (35 - 47.5\,I)\ \text{ohms}$:

Equations

Wavelength and propagation constant

> $\lambda := 1\,\text{m}$:

> $\beta := 2\cdot\pi/\lambda$:

> $\text{circuit} := \dfrac{Z_0\cdot\cos(\beta\cdot d) + I\cdot Z_L\cdot\sin(\beta\cdot d)}{Z_L\cdot\cos(\beta\cdot d) + I\cdot Z_0\cdot\sin(\beta\cdot d)} - I\cdot\cot(\beta\cdot l)$:

Stub Location

The location and length of the stub are

> $\text{fsolve}(\{\text{Re}(\text{circuit}) = 1, \text{Im}(\text{circuit}) = 0\}, \{l = 0.1\ \text{m}, d = 0.1\ \text{m}\})$

$$\{d\sim = 58.94 \times 10^{-3}\ \text{m}, l\sim = 111.18 \times 10^{-3}\ \text{m}\} \qquad \textbf{(4.1)}$$