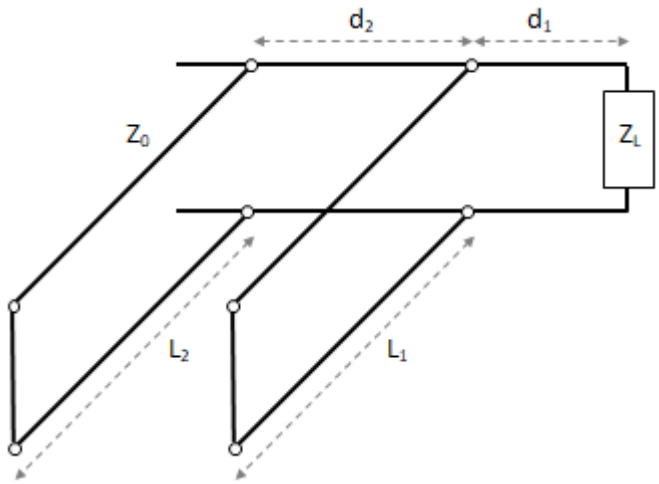
Double Stub Matching

This application will calculate the lengths L_1 and L_2 of two shunt stubs that match the load to the impedance of a transmission line.

The shunts are at a known position d_1 and d_2 from the load.



Parameters

Load and impedance

$Z_L := (23 - 38\,i)\ \text{ohm}$

$Z_0 := 100\ \text{ohm}$

Wavelength and phase constant

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

$\beta := \frac{2\cdot\pi}{\lambda} = 6.283\ \frac{1}{\text{m}}$

Position of stubs

$d_1 := 0.26\cdot\lambda$

$d_2 := 0.18\cdot\lambda$

Circuit equation

$$\text{circuit} := \frac{\cos\left(\beta\cdot d_2\right) + \frac{1\,i\cdot\sin\left(\beta\cdot d_2\right)}{\frac{Z_0\cdot\cos\left(\beta\cdot d_1\right) + 1\,i\cdot Z_L\cdot\sin\left(\beta\cdot d_1\right)}{Z_L\cdot\cos\left(\beta\cdot d_1\right) + 1\,i\cdot Z_0\cdot\sin\left(\beta\cdot d_1\right)} - 1\,i\cdot\cot\left(\beta\cdot L_1\right)}}{\frac{\cos\left(\beta\cdot d_2\right)}{\frac{Z_0\cdot\cos\left(\beta\cdot d_1\right) + 1\,i\cdot Z_L\cdot\sin\left(\beta\cdot d_1\right)}{Z_L\cdot\cos\left(\beta\cdot d_1\right) + 1\,i\cdot Z_0\cdot\sin\left(\beta\cdot d_1\right)} - 1\,i\cdot\cot\left(\beta\cdot L_1\right)} + 1\,i\cdot\sin\left(\beta\cdot d_2\right)} - 1\,i\cdot\cot\left(\beta\cdot L_2\right)$$

Analysis

Numerical solution

$$res := fsolve\left(\left\{\mathrm{Re}(circuit) = 1, \mathrm{Im}(circuit) = 0\right\}, \left\{L_1 = 0.1\,\mathrm{m}, L_2 = 0.1\,\mathrm{m}\right\}\right) \text{ assuming real}$$

$$res = \left\{L_1 = 0.298\,\mathrm{m}, L_2 = 0.086\,\mathrm{m}\right\}$$