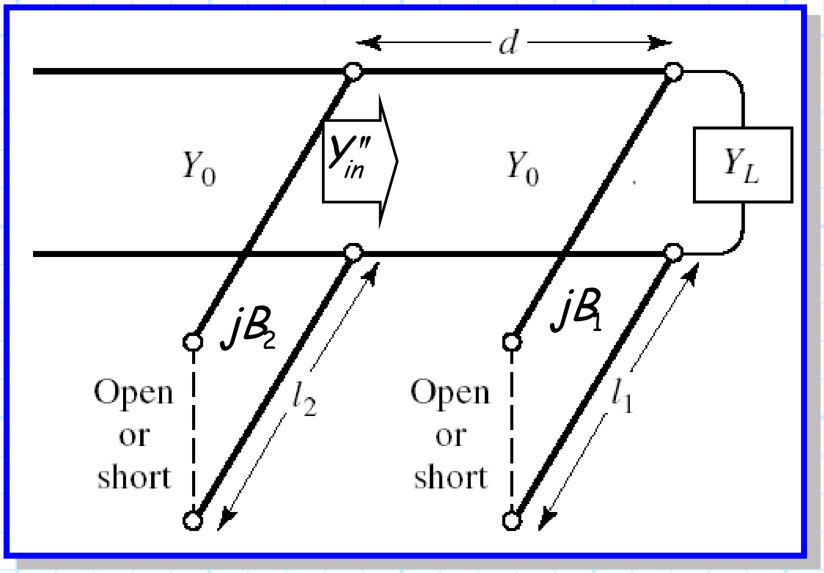
Double Stub Tuning

Another way to build a matching network is with a **double stub tuner**:



In this design, d is a **fixed** length (typically, $d = \lambda/8$), whereas lengths ℓ_1 and ℓ_2 are **design parameters**.

Q: *Why are ℓ_1 and ℓ_2 design parameters, but **not** length d?*

A: Because the lengths ℓ_1 and ℓ_2 can be **easily altered**—the matching network is physically **tunable**!

Design Procedure

1. Set jB_1 such that $\text{Re}\{Y''_{in}\} = Y_0$, i.e.,

$$\text{Re}\left\{ Y_0 \frac{(Y_L + jB_1) + jY_0 \tan\beta d}{Y_0 + j(Y_L + jB_1)\tan\beta d} \right\} = Y_0$$

or equivalently:

$$\text{Re}\left\{\frac{G_L + j\left(B_L + B_1 + Y_0 \tan\beta d\right)}{Y_0 - \left(B_L + B_1\right)\tan\beta d + j\,G_L \tan\beta d}\right\} = 1$$

where $Y_L = G_L + jB_L$.

Problem: There **may** be **no** solution jB_1 that satisfies this equation! There exists **some** load impedances Z_L (Y_L) that **cannot** be matched with a double stub tuner.

These loads are said to lie in the scary ***forbidden region*** (eq. 5.21). We will find that these load impedances have **real** (resistive) parts that are **large** (e.g., $R_L \gg Z_0$).

2. Set jB_2 such that:

$$\text{Im}\{Y_{in}'' + jB_2\} = 0$$

or equivalently:

$$B_2 = -\text{Im}\{Y_{in}''\}$$

The resulting input admittance is thus:

$$Y_{in} = Y_{in}'' + jB_2 = Y_0 \qquad \text{(real)}$$

The design equations are provided on pp. 240, **OR** we can use a Smith Chart (see **example 5.4**) to find the solutions!