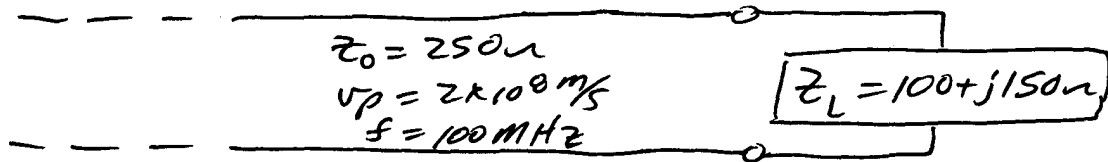For a circuit operating at 100 MHz, design and sketch a series single-stub with open circuit termination tuning network for a load $Z_L = 100 + j150 \, \Omega$ connected to a lossless transmission line (250 Ω, 2×10^8 m/s) using a Smith chart. Place the stub as close as possible to the load and make the stub as short as possible.

$$Z_0 = 250 \Omega$$
$$v_p = 2 \times 10^8 \, m/s$$
$$f = 100 \, MHz$$

$$Z_L = 100 + j150 \Omega$$

→ Calculate $z_L = \dfrac{Z_L}{Z_0} = \dfrac{100 + j150}{250} = 0.4 + j0.6 \, \Omega/\Omega$

→ Plot z_L on Smith Chart and draw $|\Gamma| = 0.56$ circle through z_L.

→ Move WTG on $|\Gamma| = 0.56$ circle to $z_{m1} = 1 + j1.35 \, \Omega$

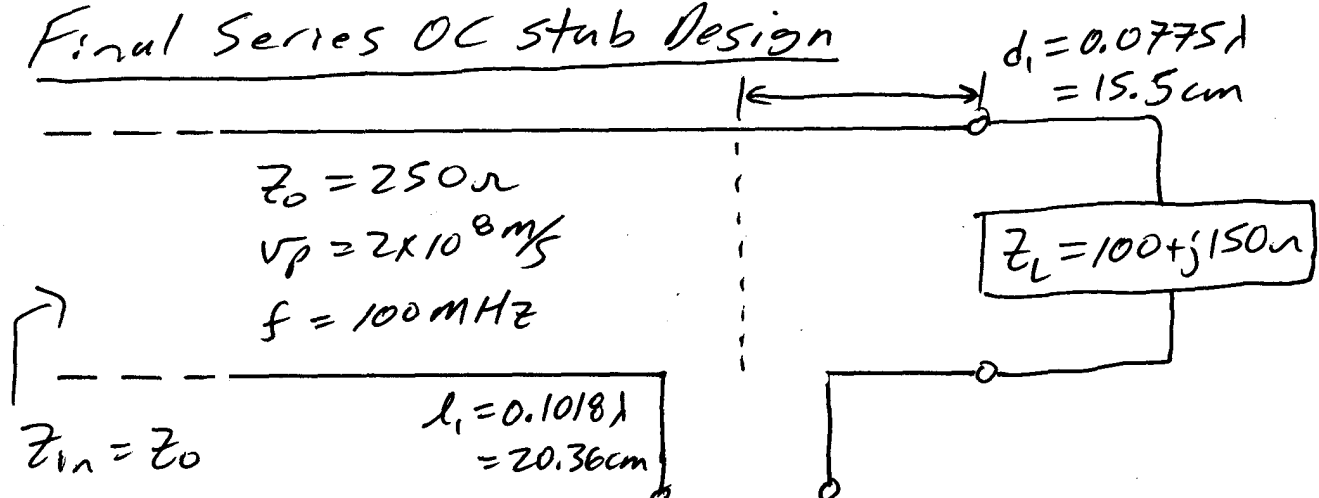$$d_1 = 0.172\lambda - 0.0945\lambda = \underline{\underline{0.0775\lambda}}$$

→ Need an open circuit stub w/ $z_{stub} = -j1.35 \, \Omega/\Omega$. Plot z_{stub}.

→ Move WTG from $z_{oc} \to \infty$ to z_{stub}

$$\ell_1 = 0.3518\lambda - 0.25\lambda = \underline{\underline{0.1018\lambda}}$$

→ Calculate $\lambda = \dfrac{v_p}{f} = \dfrac{2 \times 10^8}{100 \times 10^6} = 2 \, m$

Final Series OC stub Design

$d_1 = 0.0775\lambda = 15.5 \, cm$

$$Z_0 = 250 \Omega$$
$$v_p = 2 \times 10^8 \, m/s$$
$$f = 100 \, MHz$$

$$Z_L = 100 + j150 \Omega$$

$$Z_{in} = Z_0$$

$\ell_1 = 0.1018\lambda = 20.36 \, cm$

Simple
Smith Chart

$Z_0 = 250 \Lambda$

$V_p = 2 \times 10^8 \, m/s$

$f = 100 \, MHz$

0.0945λ

0.172λ

0.25λ

0.3518λ

$SWR \approx 3.5$

$|\Gamma| = 0.56$

RADIALLY SCALED PARAMETERS