2.66 A 200-Ω transmission line is to be matched to a computer terminal with $Z_L = (50 - j25)$ Ω by inserting an appropriate reactance in parallel with the line. If $f = 800$ MHz and $\varepsilon_r = 4$, determine the location nearest to the load at which inserting:

(a) A capacitor can achieve the required matching, and the value of the capacitor.

(b) An inductor can achieve the required matching, and the value of the inductor.

Solution:

(a) After entering the specified values for Z_L and Z_0 into Module 2.6, we have z_L represented by the red dot in Fig. P2.66(a), and y_L represented by the blue dot. By moving the cursor a distance $d = 0.093\lambda$, the blue dot arrives at the intersection point between the SWR circle and the $S = 1$ circle. At that point

$$y(d) = 1.026126 - j1.5402026.$$

To cancel the imaginary part, we need to add a reactive element whose admittance is positive, such as a capacitor. That is:

$$\begin{aligned} \omega C &= (1.54206) \times Y_0 \\ &= \frac{1.54206}{Z_0} = \frac{1.54206}{200} = 7.71 \times 10^{-3}, \end{aligned}$$

which leads to

$$C = \frac{7.71 \times 10^{-3}}{2\pi \times 8 \times 10^8} = 1.53 \times 10^{-12} \text{ F}.$$

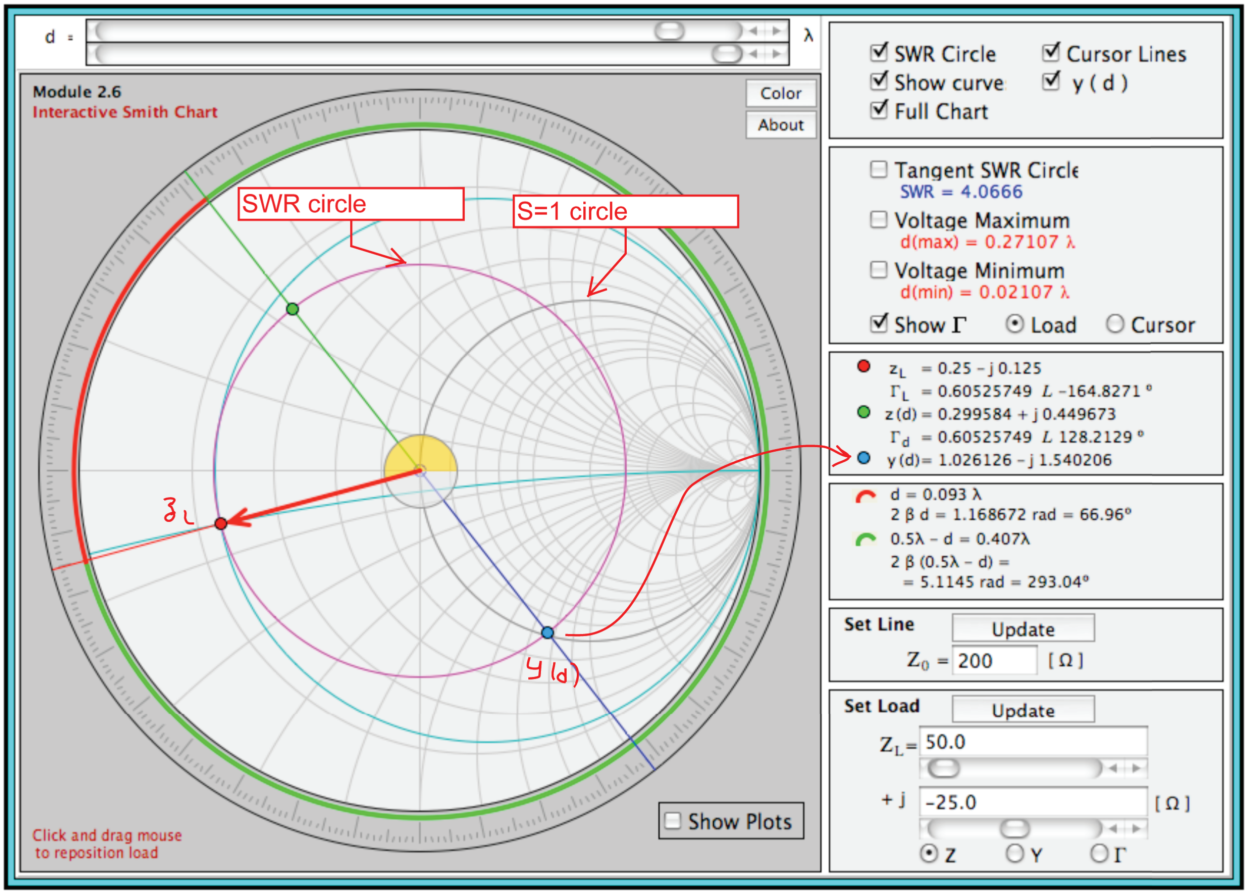

Figure P2.66(a)

(b) Repeating the procedure for the second intersection point [Fig. P2.66(b)] leads to

$$y(d) = 1.000001 + j1.520691,$$

at $d_2 = 0.447806\lambda$.

To cancel the imaginary part, we add an inductor in parallel such that

$$\frac{1}{\omega L} = \frac{1.520691}{200},$$

from which we obtain

$$L = \frac{200}{1.52 \times 2\pi \times 8 \times 10^8} = 2.618 \times 10^{-8} \text{ H}.$$

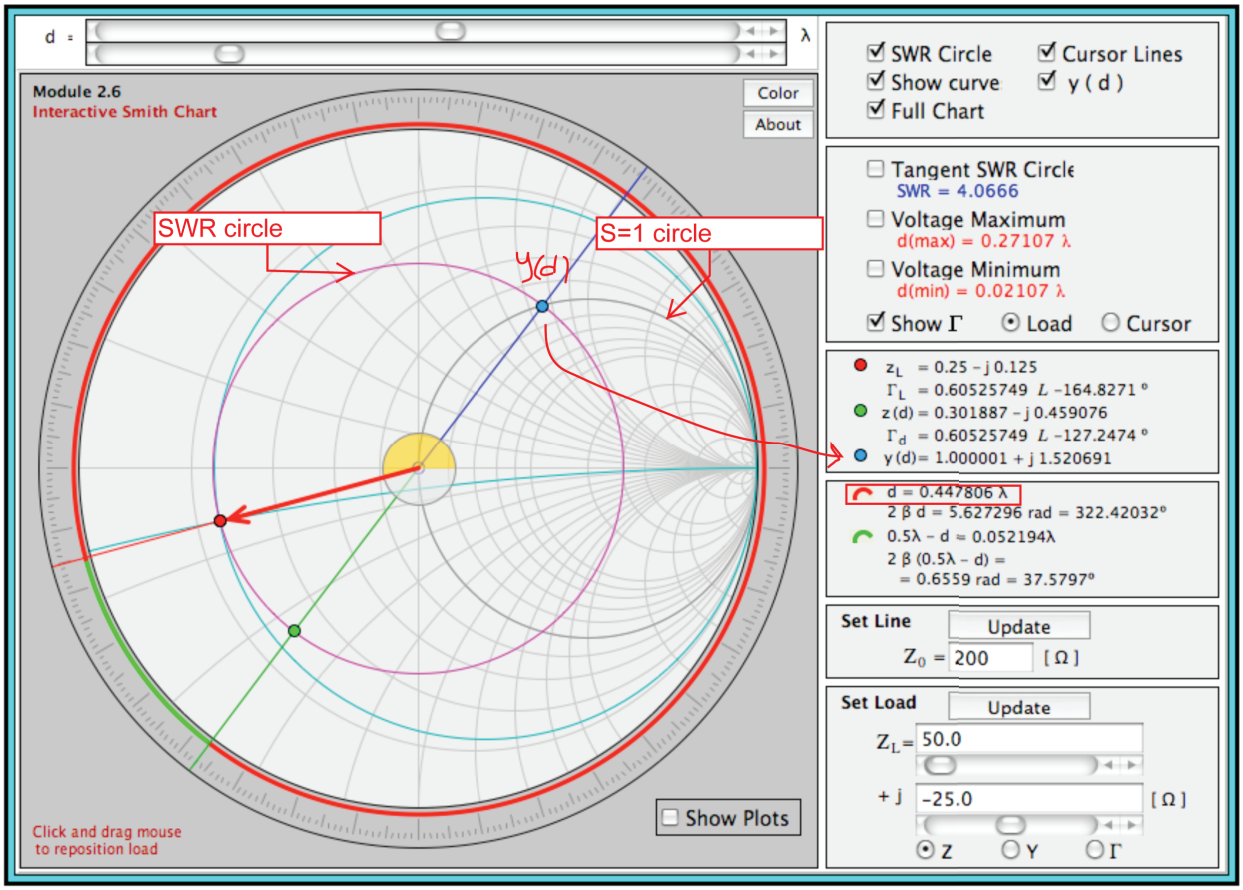

Figure P2.66(b)