Figure 3-1  Complex $\Gamma$-plane and various locations of $\Gamma_0$. 
Figure 3-2  Parametric representation of the normalized resistance $r$ in the complex $\Gamma$-plane.

Constant resistance lines ($r = \text{const}$)
Figure 3-3  Parametric representation of the normalized reactance $x$ in the complex $\Gamma$-plane.
Figure 3-4  Smith Chart representation by combining $r$ and $x$ circles for $|\Gamma| \leq 1$. 
Figure 3-5  Usage of the Smith Chart to determine the input impedance for Example 3-3.
Figure 3-6  SWR circles for various reflection coefficients.
Figure 3-7  Creating capacitive and inductive impedances via an open-circuit transmission line.
Figure 3-8  Creating capacitive and inductive impedances via a short-circuit transmission line.
smith_chart; % plot smith chart
Set_Z0(50); % set characteristic impedance to 50 Ohm
s_Load(30+j*60); % set load impedance to 30+j60 Ohm
vp=0.5*3e8; % compute phase velocity
f=2e9; % set frequency to 2 GHz
d=0.0:0.001:0.03; % set the line length to a range from 0 to 3 cm in 1 mm increments
betta=2*pi*f/vp; % compute propagation constant
Gamma=(ZL-Z0)/(ZL+Z0); % compute load reflection coefficient
rd=abs(Gamma); % magnitude of the reflection coefficient
alpha=angle(Gamma)-2*betta*d; % phase of the reflection coefficient
plot(rd*cos(alpha),rd*sin(alpha)); % plot the graph
Figure 3-9  Input impedance of a loaded line of 2 cm length for a sweep in operating frequency from 0.0 to 3 GHz. If the operating frequency is fixed at 2 GHz and the line length is varied from 0.0 to 3 cm, the same impedance curve is obtained.
Figure 3-10  Conversion from impedance to admittance by 180° rotation.
Figure 3-11  Reinterpretation of the Z-Smith Chart as a Y-Smith Chart.
Figure 3-12  The ZY-Smith Chart superimposes the Z- and Y-Smith Charts in one graphical display.
Figure 3-13  Admittance response of parallel RL circuit for $\omega_L \leq \omega \leq \omega_U$ at constant conductances $g = 0.3, 0.5, 0.7, \text{ and } 1.$
Figure 3-14  Admittance response of parallel RC circuit for $\omega_L \leq \omega \leq \omega_U$ at constant conductances $g = 0.3, 0.5, 0.7,$ and 1.
**Figure 3-15** Impedance response of series $RL$ circuit for $\omega_L \leq \omega \leq \omega_U$ and constant resistances $r = 0.3, 0.5, 0.7,$ and $1$. 

$L = 10 \text{ nH} \quad R = rZ_0$
**Figure 3-16**  Impedance response of series $RC$ circuit for $\omega_L \leq \omega \leq \omega_U$ at constant resistances $r = 0.3, 0.5, 0.7,$ and $1$. 
Figure 3-17  $T$ network connected to the base-emitter input impedance of a bipolar transistor.
Figure 3-18  Computation of the normalized input impedance of the \( T \) network shown in Figure 3-17 for a center frequency \( f = 2 \text{ GHz} \).
Figure 3-19  CAD simulation of the normalized input impedance $Z_{in}$ for the network depicted in Figure 3-17 over the entire frequency range $500 \text{ MHz} \leq f \leq 4 \text{ GHz}$. 