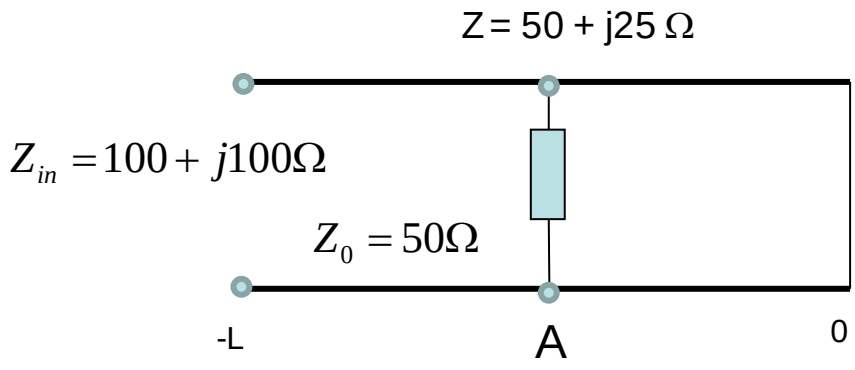
EE Problem 8

Solve the following problem using Smith chart

A lossless transmission line is shorted at the load point. The characteristic impedance Z_0 of the transmission line is 50 Ω. The length of the transmission line is unknown. A load is connected to the transmission line at the point A. The impedance of the load is Z=50+j25Ω. Find out: (1) where is the load connected? (2) the length of the transmission line?



Solution:

(1) the normalized input impedance $z_{in} = \frac{Z_{in}}{Z_0} = 2 + j2$, point C on Smith Chart

(2) the normalized input admittance y_{in} is at point D on Smith chart.

(3) the normalized load impedance $z = \frac{Z}{Z_0} = 1 + j0.5$, point E on Smith chart

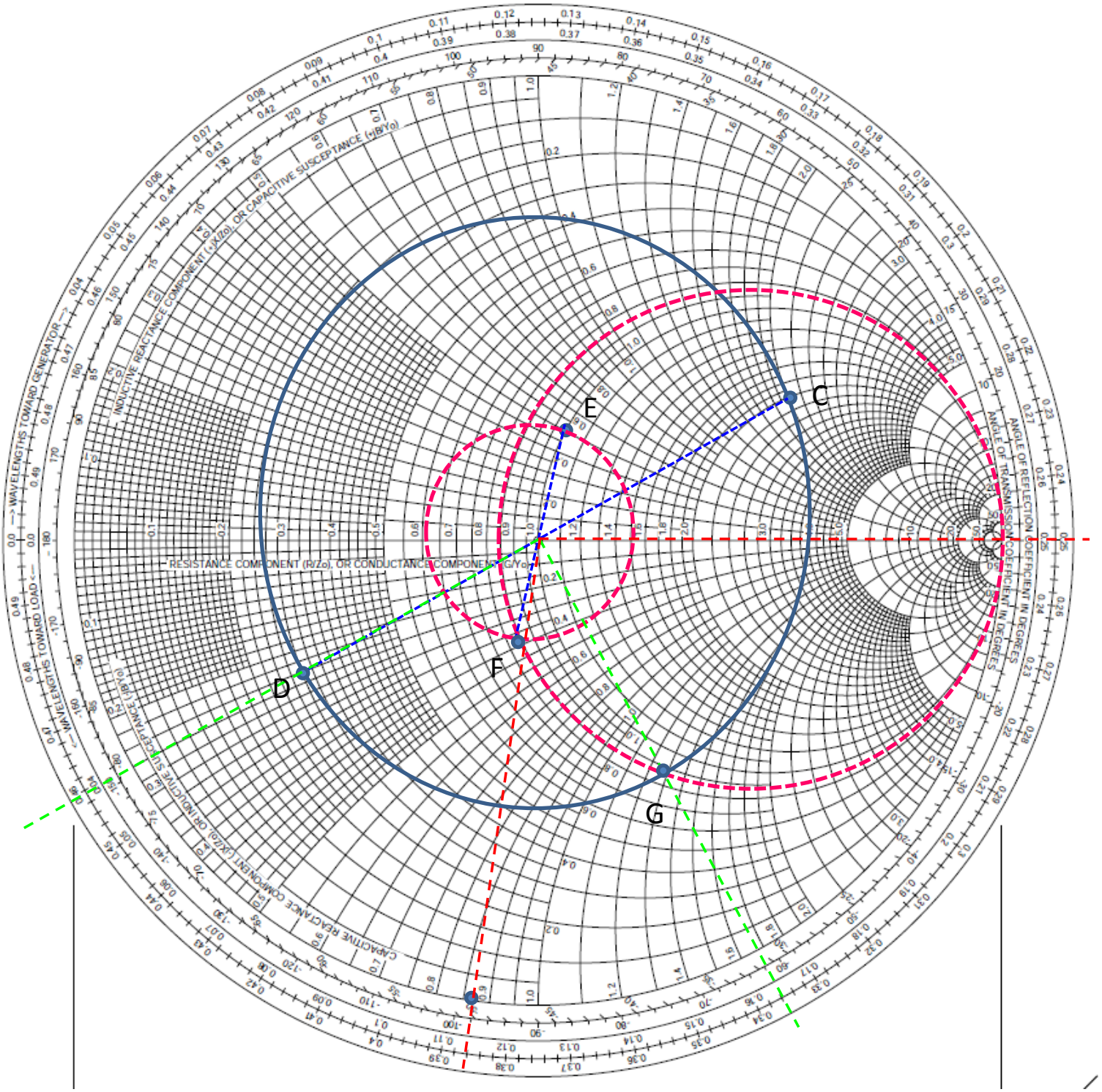
(4) the normalized load admittance is at point F on Smith chart.

(5) Since the short circuit doesn't contribute to the real part of the admittance, the total real part of the admittance at point A is 0.9.

(6) The distance from point A to the input is therefore 0.46-0.334 λ = 0.126 λ

(7) The imaginary part of the total admittance at point A is -1.3. The contribution from the short circuit is therefore -1.3-(-0.42)=-0.88.

(8) the length from the Short to point A is 0.386-0.25λ = 0.136 λ.


C
E
F
D
G
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES