

# ECE4370 HW1 Solution

Huan Yu and Prof D

Problem 1

(1)

The mismatch loss for dipole:

$$\frac{4R_L R_{Adipole}}{|Z_L + Z_{Adipole}|^2} = 0.418$$

The mismatch loss for folded dipole:

$$\frac{4R_L R_{Af-dipole}}{|Z_L + Z_{Af-dipole}|^2} = 0.603$$

Thus, the folded dipole couples the most power.

(2)

Dipole:

$$|V_{Adipole}| = \frac{2|Z_L| \sqrt{2R_{Adipole} P_R}}{|Z_L + Z_{Adipole}|} = 20.434 \sqrt{P_R}$$

Folded dipole:

$$|V_{Af-dipole}| = \frac{2|Z_L| \sqrt{2R_{Af-dipole} P_R}}{|Z_L + Z_{Af-dipole}|} = 24.556 \sqrt{P_R}$$

Thus, the folded dipole results in a larger amplitude of input voltage.

(3)

$$|V_{Adipole}| = |V_{Af-dipole}| \Rightarrow \frac{2|Z_L| \sqrt{2R_{Adipole} P_R}}{|Z_L + Z_{Adipole}|} = \frac{2|Z_L| \sqrt{2R_{Af-dipole} P_R}}{|Z_L + Z_{Af-dipole}|}$$

Thus,

$$\frac{\sqrt{73}}{|73 + 100 + jX_L|} = \frac{\sqrt{292}}{|292 + 100 + jX_L|}$$

Therefore,  $X_L = \pm 106.377$

Problem 2

2. The increase is equal to the mismatch loss

$$P_L = \frac{4R_L R_A}{\underbrace{\left[ \tilde{Z}_A + \tilde{Z}_L \right]^2}_{\text{mismatch losses}}} P_R$$

which would be 6.1 dB.