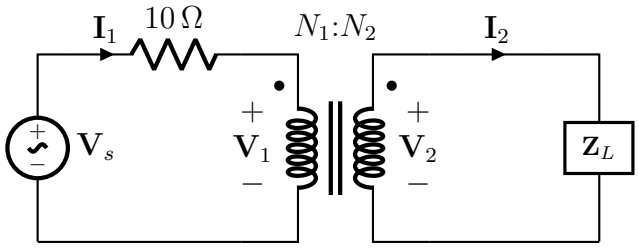
EE2015: Electric Circuits and Networks

Tutorial 10

(November 4-5, 2024)

1. Let $N_1 = 1000$ turns and $N_2 = 5000$ turns in the ideal transformer shown on the right. If $\mathbf{Z}_L = 500 - j400\,\Omega$, i) find the average power delivered to $\mathbf{Z}_L$ in each of the following two cases:
(a) $\mathbf{I}_2 = 1.4\angle 20^\circ$ A rms, (b) $\mathbf{V}_1 = 80\angle 100^\circ$ V

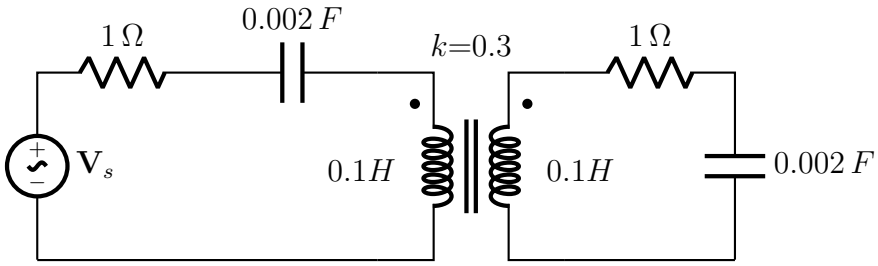


ii) For $\mathbf{V}_1 = 80\angle 100^\circ$ V, find:

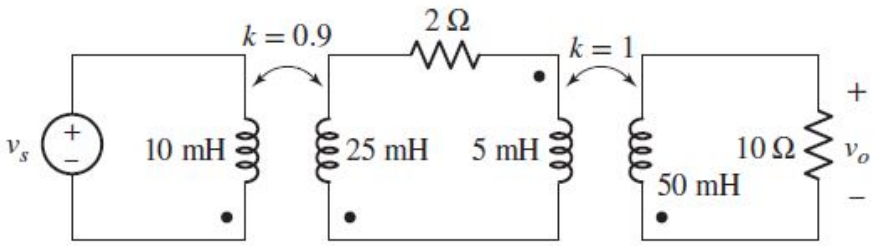
   (a) The primary side equivalent circuit that incorporates the reflected secondary side load impedance.

   (b) The secondary side equivalent circuit that incorporates the reflected primary side source impedance.

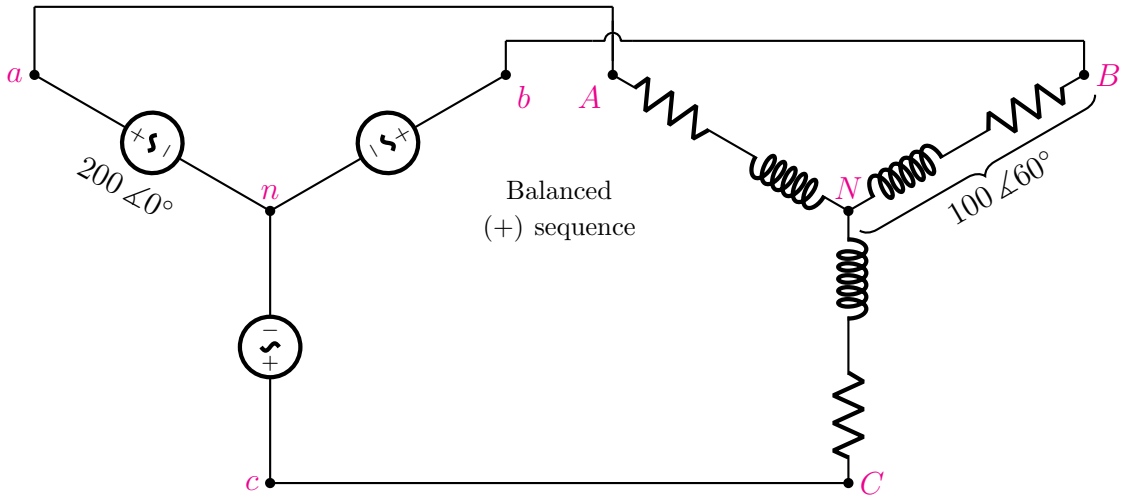
2. Find ω for which the impedance seen by the input source is purely resistive?



3. For the circuit below, find the equivalent 2-port Transmission parameters. Calculate v_o for the case where $v_s = 12$ sin 500t V.



4. For the three-phase circuit shown below, find the phase and line currents, and the phase and line voltages. What is the total power dissipated in the three-phase load? Assume that the line resistance is negligible.



5. A balanced three-phase three-wire system supplies power to a balanced Y-connected load. Assume that the line resistance is negligible. Each phase contains three loads in parallel, viz., $-j100\,\Omega$, $100\,\Omega$, and $50 + j50\,\Omega$. Assume a positive phase sequence with $\mathbf{V}_{ab} = 400\angle 0°$ V. Find (a) $\mathbf{V}_{an}$, (b) $\mathbf{I}_{aA}$, and (c) total power drawn by the load.

6. A balanced Δ-connected load with phase impedance of $23.7 + j17.1\,\Omega$ at 50 Hz is supplied from a 400 V, 50 Hz balanced Y-connected source through a line with impedance of $0.1 + j0.3\,\Omega$ in each line. Find (i) the line current and load voltage, (ii) the load-branch currents and (iii) the active and reactive power delivered by the source and delivered to the load. Redo the calculations by converting the Δ-connected load to its equivalent Y-connected load.

7. A balanced three-phase three-wire supply is terminated with two Δ-connected loads in parallel. Assume that the line resistance is negligible. Load 1 draws 40 kVA at a lagging PF of 0.8 while Load 2 absorbs 24 kW at a leading PF of 0.9. Let $\mathbf{V}_{ab} = 440\angle 30°$ V. Furthermore, assume that the line resistance is zero. Calculate the following quantities: (a) phase current $\mathbf{I}_{AB}^{(1)}$ for the lagging load, (b) $\mathbf{I}_{AB}^{(2)}$, (c) $\mathbf{I}_{aA}$, and (d) total power drawn by the loads.

8. A balanced three-phase system with a line voltage of 400 V is connected to a balanced Δ-connected load. Assume that the line resistance is negligible. Calculate the line current and per-phase load impedance if the load draws, (a) 1 kW at a lagging PF of 0.85, and (b) 300 W per phase at a leading PF of 0.92.