EGR 272
Circuit Theory II
File: N272O2

Test #2 Overview

Chapters covered

- Chapters 9-10 in **Electric Circuits, 10th Edition** by Nilsson
- Related Homework Assignments: HW #3 (Chapters 9) and HW #4 (Chapter 10) in Mastering Engineering

Chapter 9 – Sinusoidal Steady-State Analysis (AC Circuit Analysis)

Sinusoidal properties

- Relationships for V_p, V_{RMS}, T, f, and w
- Sketching waveforms
- Phase shift between waveforms (leading & lagging)

Complex Numbers

- Rectangular and polar forms
- Conversion between forms
- Complex number operations
- Finding the real or imaginary part of an expression

Complex Impedances

- Z_C, Z_L, X_C, X_L
- $Z = R + jX$, $Y = G + jB$

Phasor Analysis (AC Circuit Analysis)

- Phasor transformed circuit
- Analysis using various methods, including:
  - Combining impedances in series and parallel
  - KVL and KCL
  - Voltage division and current division
  - Source transformations
  - Mesh and Node equations
  - Superposition
- KVL and KCL: satisfied by phasors, not by magnitudes

Resonance

- Series and parallel resonant circuits
- Expressions for w_o and f_o
- Finding currents or voltages at resonance

Transformers

- $a = \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}, \quad a^2 = \frac{Z_1}{Z_2}$
- Two key ways to analyze transformer circuits:
  - Using KVL, KCL, and turns ratio expressions ($V_1 = aV_2$, $I_2 = aI_1$)
- Using reflected impedance

(continued)

Chapter 10 – Sinusoidal Steady-State Power Calculations

Finding the average and RMS value of periodic waveforms

$$P = \frac{1}{T}\int_0^T p(t)dt \qquad V_{RMS} = \sqrt{\frac{1}{T}\int_0^T v^2(t)dt} \qquad I_{RMS} = \sqrt{\frac{1}{T}\int_0^T i^2(t)dt}$$

RMS values of sinusoidal waveforms

$$V_{RMS} = \frac{V_p}{\sqrt{2}} = 0.707V_p \qquad I_{RMS} = \frac{I_p}{\sqrt{2}} = 0.707I_p$$

Various relationships for p(t), P, Q, |S|, $\bar{S}$, and p.f.

Two key ways to find power in a circuit (with a single voltage source)

- Find total source current and use $\bar{S} = V_{RMS}I_{RMS}^{*} = P + jQ = |S|\angle\theta$
- Find P and Q for each component (or subsystem)

Power Factor Correction

- Find the value of parallel capacitance to correct to unity p.f.
- Find the value of parallel capacitance to correct to a specific p.f., such as 0.95, lagging
- Find the source current before and after power factor correction in each case above