Portland State University

Electrical & Computer Engineering

EE 347 Power Systems I

-Homework #4-

Text Questions: 9-2, 9-9, 9-10, 9-12

Text Problems: 9-16[1]

Problem 1:

A 500 kV, 150 MVA three-phase transmission line will use ACSR conductors. The line is 95 miles long, and the conductors are arranged in an equilateral triangle formation with sides of 8 ft. Nominal operating temperature is 50 °C.[2]

Write a script that can determine the following parameters:

a. Per phase, find the AC resistance per 1000 ft and the total resistance of the line.

b. Per phase, find the inductive reactance per 1000 ft and the total inductive reactance of the line.

c. Per phase, find the capacitive admittance per 1000 ft and the total capacitive admittance.

d. Calculate the ABCD matrix coefficients appropriate for the given length.

Demonstrate the capabilities of your script by showing results for three ACRS conductors appropriate for this particular transmission line.

Problem 2:

Consider the PowerWorld model from HW#3 P1.

- Relieve the overload conditions within the transmission line and transformers by providing reactive compensation.
- Determine how much capacity can be opened up on the transmission line by providing this compensation.
- Turn in a new one-line showing the flow of both real and reactive power. Comment on the new reactive power flows.

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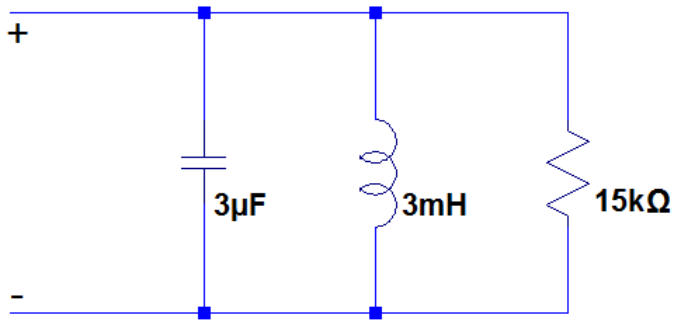
[1] Text Errata: use 150 MW rather than 50 MW.

[2] In this problem, the line length is uncharacteristically long (resulting in a high VR) and the power flow uncharacteristically low (in order to keep VR reasonable). A real transmission line would have spans of around 70 miles, between which would be placed series capacitors to decrease the line reactance (and lower VR).

Fundamentals of Engineering Exam Problem 1:

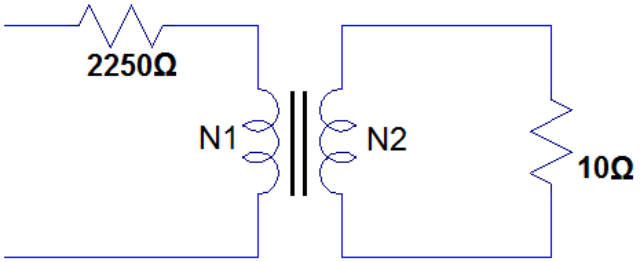
The resonant frequency of the circuit shown is most nearly (Hz):



(A) 1.68×10^1
(B) 10.5×10^1
(C) 1.68×10^3
(D) 10.5×10^4

Fundamentals of Engineering Exam Problem 2:

What is the turns ratio (N1:N2) for maximum power transfer in the following circuit?



(A) 15:1
(B) 30:1
(C) 1:15
(D) 1:30