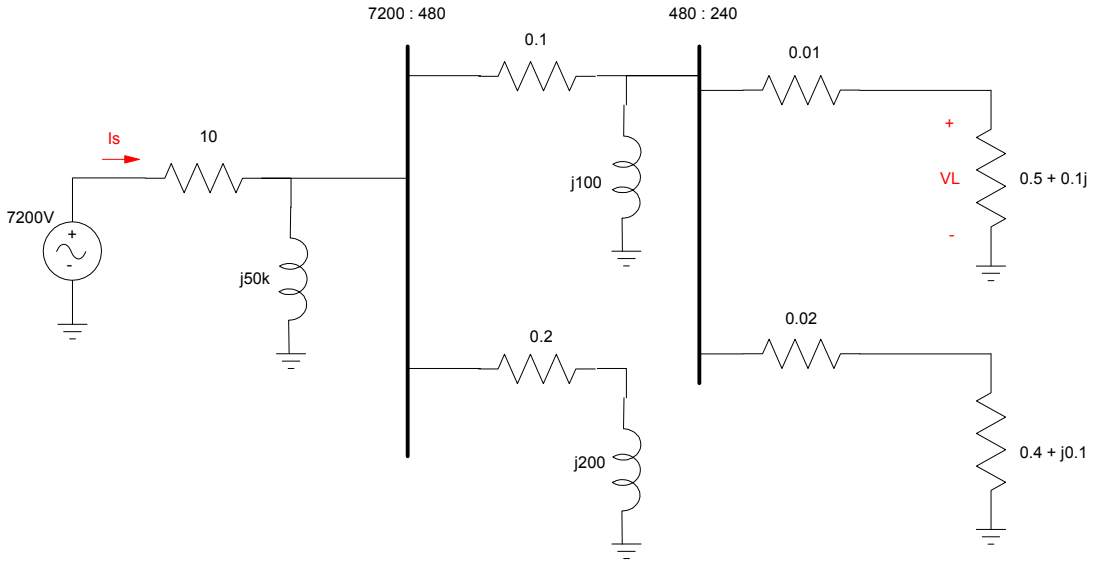
# ECE 331 - Homework #6

Per-unit analysis. Life Cycle Costing
Due Monday, March 3, start of class

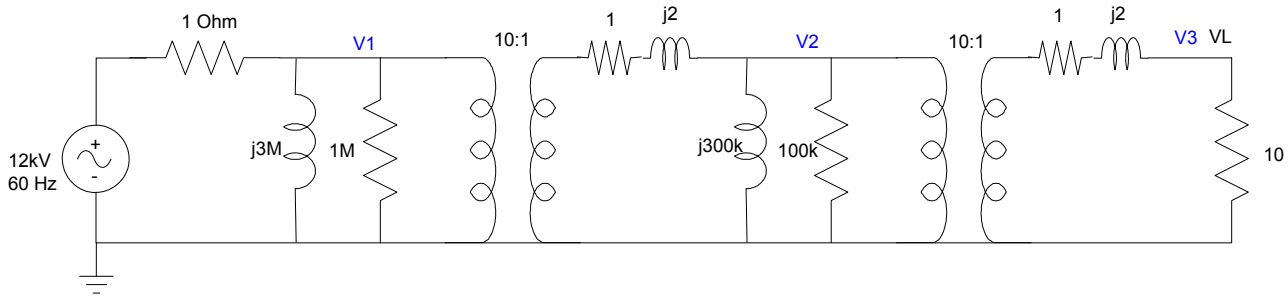
**Per-Unit Analysis:** Consider the following utility grid:




1) Convert this to a per-unit basis using
   - Vo = line voltage
   - Po = 100kVA
2) Determine Is and VL on
   - A per-unit basis, and
   - In terms of amps and volts.

3a) Convert the following circui to a per-unit basis using Vo = line voltage and Po = 100kVA.

3b) Solve for the voltage at the load and the source current in terms of
   - In terms of per units, and
   - In terms of amps and volts



***Time Value of Money***

Two transformers have the following cost per year

| year | Initial Cost (year 0) | Annual Operation Cost (year 0..19) | Disposal Cost (year 20) |
|---|---|---|---|
| A | $10,000 | $300 (1% of 50kVA load) | $0 |
| B | $0 | $600 (2% of 50kVA load) | $15,000 |

4) Assuming an interest rate of 2.61% (the current 10-year t-bill), which transformer has the lower present-value cost to the utility?

5) Assuming an interest rate of 11% (roughly used in the stock market), which transformer has the lower present-value cost to the utility?

Problem 6 & 7: Cost vs. Efficiency. Assume you are deciding between two transformers: A and a second one with lower initial cost but higher copper and core losses. Assume both have a disposal cost of $0.

| year | Initial Cost (year 0) | Annual Operation Cost at 9 cents / kWh (year 0..19) | Annual Operation Cost at 18 cents / kWh (year 0..19) |
|---|---|---|---|
| A | $10,000 | $300 (1% of 50kVA load) | $600 (1% of 50kVA load) |
| B | $5,000 | $600 (2% of 50kVA load) | $1200 (2% of 50kVA load) |

6) If electricity is 9 cents / kilowatt hour, which transformer is the better buy?

7) If electricity is 18 cents a kilowatt hour, which transformer is the better buy?