EE544 Homework 1

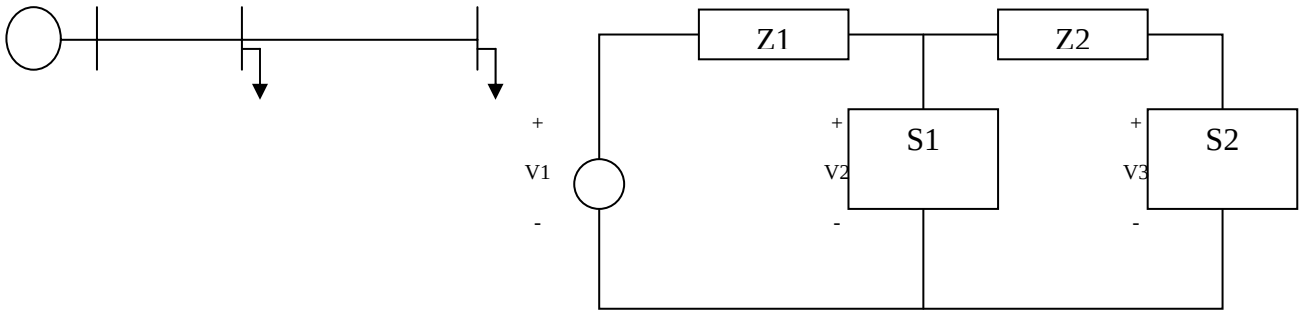
"Warmups"

The first part of EE544 deals with short term planning which primarily involves power flow analysis, motor start and short circuit study/protection. These studies are, of course, also the basic studies in EHV power systems as well as Industrial power systems. The US distribution system is unique in its inherently unbalanced design. Thus, we will be extending our conventional per phase, balanced system analyses to the unbalanced case. This homework will review concepts as they apply to balanced and single phase systems. The Glover and Sarma text should be adequate.

1. The one-line diagram of a balanced three phase, radial system with one source is shown below. The per phase impedance diagram is also shown,

Data are as follows:

Positive sequence impedances Z1=Z2 = 0.1 + j 0.3 pu
Loads S1=S1 = 0.3 + j 0.1 pu
Source voltage |V1| = 1 pu



Use the Gauss-Seidel method to find V2 and V3 to within 0.001 pu

2. Problem 2.2 from Kersting, 2nd Ed.

2.2 Two transformers each serving four customers are shown in Figure 2.13. The following table gives the time interval and kVA demand of the four customer demands during the peak load period of the year. Assume a power factor of 0.9 lagging.

1. For each transformer determine the following:
   a. 30-minute maximum kVA demand
   b. Noncoincident maximum kVA demand
   c. Load factor
   d. DF
   e. Suggested transformer rating (50, 75, 100, 167)
   f. Utilization factor
   g. Energy (kWh) during the 4-hour period

Time	#1	#2	#3	#4	#5	#6	#7	#8
3:00–3:30	10	0	10	5	15	10	50	30
3:30–4:00	20	25	15	20	25	20	30	40
4:00–4:30	5	30	30	15	10	30	10	10
4:30–5:00	0	10	20	10	13	40	25	50
5:00–5:30	15	5	5	25	30	30	15	5
5:30–6:00	15	15	10	10	5	20	30	25
6:00–6:30	5	25	25	15	10	10	30	25
6:30–7:00	10	50	15	30	15	5	10	30

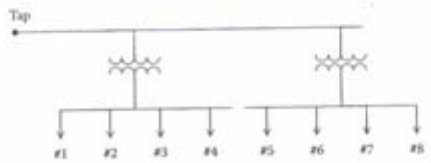


FIGURE 2.13
System for Problem 2.2.

2. Determine the maximum diversified 30-minute kVA demand at the "Tap"

3. Normalize the load data for customer #1 by dividing actual load by maximum load.
   Also normalize the data for Customer 2 and the tap using their respective maximum values
   Define the load duration curve as T(L) the duration of time in % that normalized Load exceeds L,
   With 0<L<1. Draw and compare the load duration curves for Customer 1, Customer 2 and the Tap.
   How does load diversity affect the shape of the Load duration
curve?