University of Cape Town

EEE3100S

POWER ENGINEERING

PWS Assignment

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2 Introduction

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3 Task 1: Power Flow Preparation

From the single line diagram [**1**], all positive-sequence impedances, load, and voltage data is converted to per-unit.

The common $S_{base} = 10MVA$ (three-phase), while the $V_{base} = 13.8kV$(line-to-line) in the zone of the lines.

The Z_{base} of the transmission lines is given by:

$$Z_{base} = \frac{(V_{base})^2}{S_{base}} \tag{1}$$

While the per-unit value is given by:

$$Z_{p.u} = \frac{Z_{nominal}\,[\Omega]}{Z_{base}} \tag{2}$$

Since we know that $Z = zl$, the given z_1 must first be multiplied by the lengths of the line to find the total impedances along each line. Table 1

<u>Transmission Lines</u>

Table 1: Impedances & Per-Unit Values Of Transmission Lines

Line	Length (km)	$Z\,[\Omega]$	Z_{pu}
L1	2	0.38 + 0.76j	0.02 + 0.04j
L2	1	0.19 + 0.38j	0.01 + 0.02j
L3	2	0.38 + 0.76j	0.02 + 0.04j
L4	2	0.38 + 0.76j	0.02 + 0.04j
L5	2	0.38 + 0.76j	0.02 + 0.04j

Transformer T1

$$X_{p.u} = 0.1 * \left(\frac{10MVA}{5MVA}\right) = 0.2p.u$$

Generator G1

$$X_{p.u} = 0.15 * \left(\frac{10MVA}{50MVA}\right) = 0.03p.u$$

Loads

$$S_{p.u} = \frac{(800 + 380j)kVA}{10MVA} = (0.08 + 0.038j)p.u$$

Table 2: Bus Input Data

Bus	Bus Type	V [p.u]	$\delta°$	P_G [p.u]	Q_G [p.u]	P_L [p.u]	Q_L [p.u]	Q_{max} [p.u]	Q_{min} [p.u]
1	Swing	1.0	0	-	-	0	0	-	-
2	Load	-	-	0	0	0.08	0.038	-	-
3	Load	-	-	0	0	0.08	0.038	-	-
4	Load	-	-	0	0	0.08	0.038	-	-
5	Load	-	-	0	0	0.08	0.038	-	-
6	Load	-	-	0	0	0.08	0.038	-	-
7	Load	-	-	0	0	0.08	0.038	-	-

Table 3: Line Input Data

Bus-to-Bus	R' [p.u]	X' [p.u]	G' [p.u]	B' [p.u]	MVA_{max} [p.u]
2-3	0.02	0.04	-	$1.5 * 10^{-4}$	0.2
3-4	0.01	0.02	-	$7.6 * 10^{-5}$	0.2
4-5	0.02	0.04	-	$1.5 * 10^{-4}$	0.2
5-6	0.02	0.04	-	$1.5 * 10^{-4}$	0.2
6-7	0.02	0.04	-	$1.5 * 10^{-4}$	0.2

Table 4: Transformer Input Data

Bus-to-Bus	R [p.u]	X [p.u]	G_c [p.u]	B_m [p.u]	MVA_{max} [p.u]	Max TAP setting [p.u]
1-2	-	0.2			0.2	-

4 Task 2: Power Flow

Theory intro here...

5 Task 3: Fault Analysis

Theory intro here...

6 Conclusions

These are the conclusions. [**1**]

7 References

References

[1] Sample Sample. *Sample*. URL: http://www.google.com.