

ECE 842 State Estimation Problem

A five bus power system network is described below:

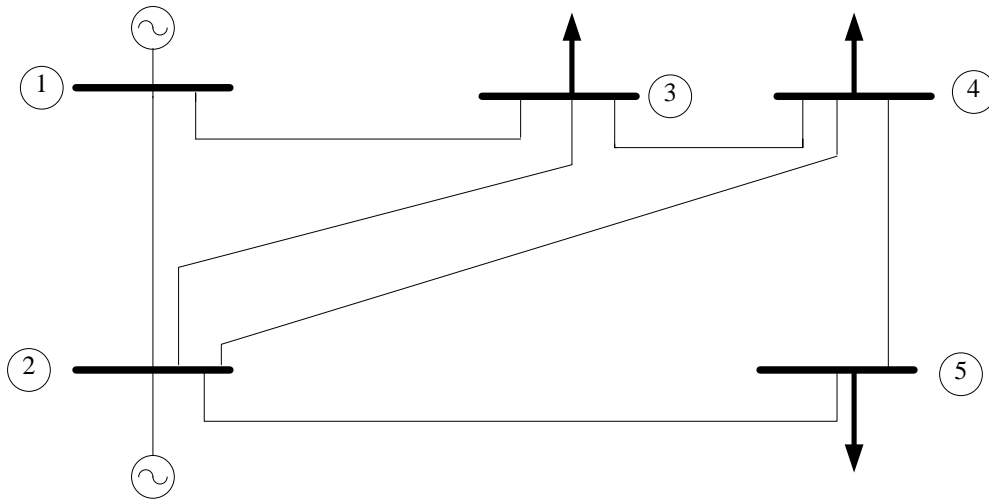


Table I (MVA Base = 100 MVA)

BRANCH	BRANCH IMPEDANCE	SHUNT ADMITTANCE (B/2)
1-2	$0.02 + j 0.06$	$0.0 + j 0.030$
1-2	$0.08 + j 0.24$	$0.0 + j 0.025$
2-3	$0.06 + j 0.18$	$0.0 + j 0.020$
2-4	$0.06 + j 0.18$	$0.0 + j 0.025$
2-5	$0.04 + j 0.12$	$0.0 + j 0.015$
3-4	$0.01 + j 0.03$	$0.0 + j 0.010$
4-5	$0.08 + j 0.24$	$0.0 + j 0.025$

Table II

<i>BUS NO.</i>	<i>TYPE</i>	<i>VOLTAGE</i>	<i>INJECTIONS AT T = 0</i>
1	SWING	1.06	-
2	GEN	-	$0.20 + j 0.20$
3	LOAD	-	$- 0.45 - j 0.45$
4	LOAD	-	$- 0.40 - j 0.05$
5	LOAD	-	$- 0.6 - j 0.10$

- Assume that the measurement vector $[Z]$ is :

$$[Z]^t = [|V_1|, |V_2|, |V_3|, |V_4|, |V_5|, P_2, P_3, P_4, P_5, Q_2, Q_3, Q_4, Q_5],$$

Where the injections (i.e. P&Q) are given in Table II .

- The bus voltage measurements are :

$$|V_1| = 1.06, |V_2| = 0.98, |V_3| = 0.958, |V_4| = 0.9, |V_5| = 0.89$$

Assume one percent error for each measurement (i.e. $\sigma = 0.01$) . **Determine** :

- A) [H]
- B) [C]
- C) [K]
- D) The new estimates of bus voltages

Use the following initial bus voltages:

$$V_1 = 1.06 \angle -5^\circ, V_2 = 0.98 \angle -3^\circ, V_3 = 0.958 \angle -6^\circ$$

$$V_4 = 0.9 \angle -10^\circ, V_5 = 0.89 \angle -10^\circ$$

(Please note positive injections are for generation and negative injections are for loads)

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