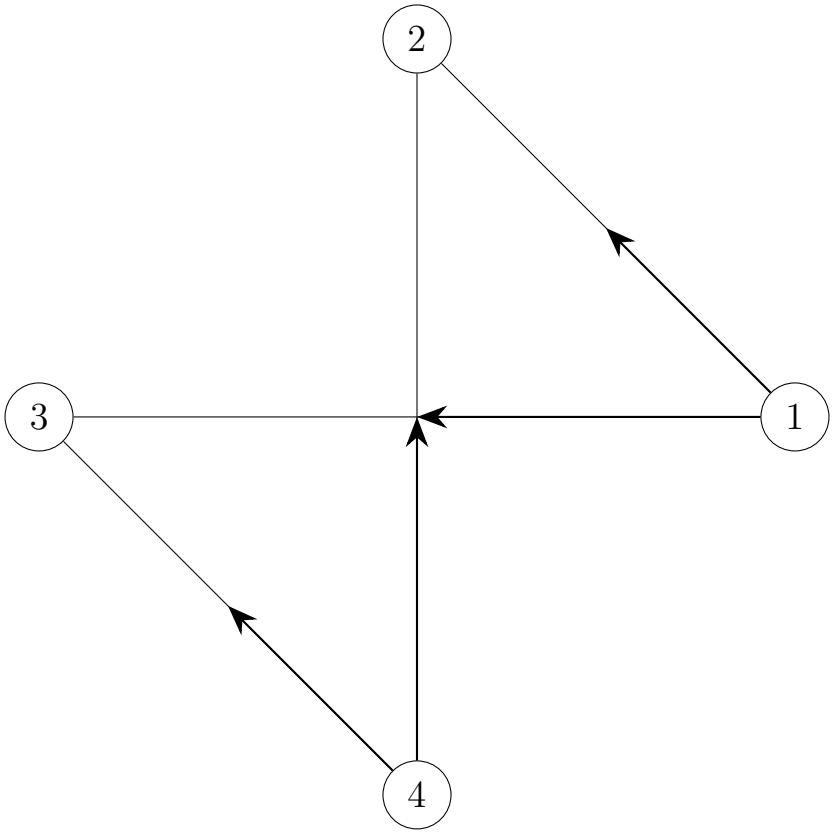
POWER FLOW ANALYSIS

4 - Bus System

February 11, 2026



$\longrightarrow$ indicates the direction of active power flow.

System Data

Buses

Bus		Load		Generator				Shunt	
No.	V_n (kV)	P (MW)	Q (MW)	P (MW)	P_{max} (MW)	Q_{min} (MVAr)	Q_{max} (MVAr)	G (pu)	B (pu)
1	230.0	50.00	30.99	0.00	900.00	-900.00	900.00	–	–
2	230.0	170.00	105.35	–	–	–	–	–	–
3	230.0	200.00	123.94	–	–	–	–	–	–
4	230.0	80.00	49.58	318.00	900.00	-900.00	900.00	–	–

Lines

From	To	R (pu)	X (pu)	B_{sh} (pu)	I_{max} (kA)
1	2	0.01008	0.0504	0.1025	5.0
1	3	0.00744	0.0372	0.0775	5.0
2	4	0.00744	0.0372	0.0775	5.0
3	4	0.01272	0.0636	0.1275	5.0

Results

Buses

Bus	V_{mag} (pu)	V_{ang} (°)	P (MW)	Q (MVAr)
1	1.000	0.000	-136.81	-83.51
2	0.982	-0.976	170.00	105.35
3	0.969	-1.872	200.00	123.94
4	1.020	1.523	-238.00	-131.85

Lines

From	To	F:T P (MW)	F:T Q (MVAr)	T:F P (MW)	T:F Q (MVAr)	P_{losses} (MW)	Q_{losses} (MVAr)
1	2	38.692	22.298	-38.465	-31.236	0.227	-8.938
1	3	98.118	61.212	-97.086	-63.569	1.031	-2.356
2	4	-131.535	-74.114	133.251	74.920	1.715	0.806
3	4	-102.914	-60.371	104.749	56.930	1.835	-3.441

Generators

Bus	P (MW)	Q (MVAr)	P_{max} (MW)	Q_{min} (MVAr)	Q_{max} (MVAr)
1	186.809	114.501	900.000	-900.000	900.000
4	318.000	181.430	900.000	-900.000	900.000

Bus					Generation		Load		Shunt		Line Flow		
No.	Type	V_{base} (kV)	V_{mag} (pu)	V_{ang} (°)	P (MW)	Q (MVAr)	P (MW)	Q (MVAr)	G (MW)	B (MVAr)	To Bus	P_{losses} (MW)	Q_{losses} (MVAr)
1	SL	230	1.000	0.000	186.809	114.501	50	30.99	0	0	2	38.69	22.30
											3	98.12	61.21
2	PQ	230	0.982	-0.976	0	0	170	105.35	0	0	1	-38.46	-31.24
											4	-131.54	-74.11
3	PQ	230	0.969	-1.872	0	0	200	123.94	0	0	1	-97.09	-63.57
											4	-102.91	-60.37
4	PV	230	1.020	1.523	318	181.43	80	49.58	0	0	2	133.25	74.92
											3	104.75	56.93

170 MW
105.35 MVAr
2
-38.46 - j31.24 MVA
38.69 + j22.30 MVA
-131.54 - j74.11 MVA
186.809 MW
114.501 MVAr
200 MW
123.94 MVAr
3
-97.09 - j63.57 MVA
98.12 + j61.21 MVA
1
50 MW
30.99 MVAr
-102.91 - j60.37 MVA
104.75 + j56.93 MVA
133.25 + j74.92 MVA
4
80 MW
49.58 MVAr
318 MW
181.43 MVAr