

Case ID: 12BusCase\_networkdata.xlsx

radial\_bus\_location =

Empty matrix: 0-by-1

B\_diag =

(1,1)	5.0000
(2,2)	5.0000
(3,3)	3.3333
(4,4)	4.0000
(5,5)	10.0000
(6,6)	3.3333
(7,7)	5.0000
(8,8)	3.8462
(9,9)	10.0000
(10,10)	2.5000
(11,11)	3.3333
(12,12)	5.0000
(13,13)	5.0000
(14,14)	3.3333
(15,15)	4.0000
(16,16)	10.0000
(17,17)	3.3333
(18,18)	5.0000
(19,19)	3.8462
(20,20)	10.0000
(21,21)	2.5000
(22,22)	3.3333
(23,23)	1.2500
(24,24)	1.2500
(25,25)	1.2500

A\_alt =

(1,1)	1
(2,1)	1
(3,1)	1
(1,2)	-1
(4,2)	1
(5,2)	1
(6,2)	1
(7,2)	1
(4,3)	-1
(8,3)	1
(9,3)	1
(23,3)	1
(2,4)	-1

(5,4) -1  
(10,4) 1  
(25,4) 1  
(3,5) -1  
(6,5) -1  
(8,5) -1  
(10,5) -1  
(11,5) 1  
(24,5) 1  
(7,6) -1  
(9,6) -1  
(11,6) -1  
(12,7) 1  
(13,7) 1  
(14,7) 1  
(12,8) -1  
(15,8) 1  
(16,8) 1  
(17,8) 1  
(18,8) 1  
(24,8) -1  
(15,9) -1  
(19,9) 1  
(20,9) 1  
(23,9) -1  
(13,10) -1  
(16,10) -1  
(21,10) 1  
(25,10) -1  
(14,11) -1  
(17,11) -1  
(19,11) -1  
(21,11) -1  
(22,11) 1  
(18,12) -1  
(20,12) -1  
(22,12) -1

AFACT MATRIX

Monitored GENERATOR  
Line

	1	2	3	4	5	6✓
7	8	9	10	11	12	
1 to 2	0.0000	-0.4696	-0.3970	-0.3161	-0.3214	-0.4031✓
-0.3433	-0.3435	-0.3492	-0.3419	-0.3453	-0.3469	
1 to 4	0.0000	-0.3161	-0.3046	-0.4972	-0.2800	-0.3033✓
-0.3628	-0.3587	-0.3541	-0.3691	-0.3595	-0.3563	
1 to 5	0.0000	-0.2143	-0.2984	-0.1867	-0.3985	-0.2936✓
-0.2939	-0.2978	-0.2968	-0.2890	-0.2952	-0.2968	

2 to 3	0.0000	0.0581	-0.3205	0.0092	-0.1009	-0.1773✓
-0.1319	-0.1342	-0.1533	-0.1247	-0.1391	-0.1455	
2 to 4	0.0000	0.3070	0.1849	-0.3622	0.0828	0.1996✓
-0.0389	-0.0302	-0.0098	-0.0545	-0.0286	-0.0188	
2 to 5	0.0000	0.0988	-0.0337	0.0240	-0.1843	-0.0249✓
-0.0650	-0.0688	-0.0640	-0.0611	-0.0650	-0.0655	
2 to 6	0.0000	0.0665	-0.2277	0.0128	-0.1190	-0.4004✓
-0.1076	-0.1103	-0.1220	-0.1017	-0.1126	-0.1171	
3 to 5	0.0000	0.0582	0.2694	0.0189	-0.1156	0.1418✓
0.0518	0.0497	0.0736	0.0494	0.0587	0.0643	
3 to 6	0.0000	-0.0121	0.3459	0.0027	0.0141	-0.3575✓
0.1144	0.1150	0.1393	0.1084	0.1226	0.1296	
4 to 5	0.0000	-0.0027	-0.0715	0.1086	-0.1589	-0.0686✓
-0.0390	-0.0440	-0.0455	-0.0322	-0.0416	-0.0444	
5 to 6	0.0000	-0.0544	-0.1182	-0.0155	0.1049	-0.2420✓
-0.0068	-0.0047	-0.0173	-0.0067	-0.0100	-0.0126	
7 to 8	0.0000	-0.0002	-0.0031	0.0041	-0.0059	-0.0028✓
0.3938	-0.0741	-0.0064	0.0756	0.0731	-0.0104	
7 to 10	0.0000	0.0015	0.0104	-0.0063	0.0073	0.0074✓
0.3777	0.0594	0.0730	-0.1210	0.1030	0.0748	
7 to 11	0.0000	-0.0013	-0.0073	0.0022	-0.0013	-0.0046✓
0.2285	0.0147	-0.0666	0.0454	-0.1762	-0.0643	
8 to 9	0.0000	-0.0045	-0.0236	0.0037	0.0012	-0.0139✓
0.0775	0.1316	-0.2388	0.0885	-0.0200	-0.0980	
8 to 10	0.0000	0.0033	0.0272	-0.0209	0.0264	0.0205✓
-0.0324	0.2668	0.1589	-0.3931	0.0598	0.1703	
8 to 11	0.0000	-0.0011	-0.0052	-0.0006	0.0026	-0.0027✓
-0.0341	0.0641	-0.0623	-0.0049	-0.2249	-0.0574	
8 to 12	0.0000	-0.0034	-0.0175	0.0023	0.0016	-0.0102✓
0.0436	0.1072	-0.1798	0.0590	-0.0750	-0.3552	
9 to 11	0.0000	0.0030	0.0167	-0.0042	0.0018	0.0102✓
-0.1139	-0.0527	0.1577	-0.0908	-0.2403	0.0280	
9 to 12	0.0000	0.0045	0.0240	-0.0045	0.0000	0.0143✓
-0.1067	-0.1146	0.2374	-0.1032	-0.1000	-0.4654	
10 to 11	0.0000	-0.0017	-0.0107	0.0048	-0.0047	-0.0071✓
-0.0175	-0.0187	-0.0864	0.0946	-0.1836	-0.0856	
11 to 12	0.0000	-0.0011	-0.0065	0.0022	-0.0016	-0.0041✓
0.0631	0.0074	-0.0576	0.0443	0.1749	-0.1794	
3 to 9	0.0000	0.0120	0.0642	-0.0124	0.0006	0.0384✓
-0.2981	-0.2989	-0.3662	-0.2825	-0.3203	-0.3395	
5 to 8	0.0000	-0.0055	-0.0159	-0.0197	0.0378	-0.0033✓
-0.3392	-0.3562	-0.3155	-0.3262	-0.3332	-0.3298	
4 to 10	0.0000	-0.0064	-0.0483	0.0320	-0.0384	-0.0351✓
-0.3627	-0.3449	-0.3184	-0.3914	-0.3465	-0.3307	

POWER TRANSFER DISTRIBUTION FACTOR (PTDF) MATRIX  
Monitored Transaction  
Line From(Sell) - To(Buy)

1 to 2	1 to 4	1 to 5	2 to 3	2 to 4	2 to 5	2✓
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to 6	3 to 5	3 to 6	4 to 5	5 to 6	7 to 8	7 to 10	7 to 11✓
8 to 9	8 to 10	8 to 11	8 to 12	9 to 11	9 to 12	10 to 11	11 to✓
12	3 to 9	5 to 8	4 to 10				
1 to 2	0.4696	0.3161	0.3214	-0.0726	-0.1535	-0.1482✓	
-0.0665	-0.0756	0.0060	0.0053	0.0817	0.0002	-0.0015✓	
0.0019	0.0056	-0.0016	0.0017	0.0034	-0.0039	-0.0022✓	
0.0034	0.0017	-0.0479	0.0221	0.0258			
1 to 4	0.3161	0.4972	0.2800	-0.0115	0.1811	-0.0361✓	
-0.0128	-0.0246	-0.0013	-0.2172	0.0232	-0.0041	0.0063✓	
-0.0033	-0.0046	0.0105	0.0009	-0.0023	0.0055	0.0022✓	
-0.0096	-0.0032	0.0495	0.0786	-0.1281			
1 to 5	0.2143	0.1867	0.3985	0.0841	-0.0276	0.1843✓	
0.0794	0.1002	-0.0047	0.2119	-0.1049	0.0040	-0.0049✓	
0.0013	-0.0010	-0.0088	-0.0026	-0.0010	-0.0016	-0.0000✓	
0.0062	0.0016	-0.0016	-0.1007	0.1023			
2 to 3	-0.0581	-0.0092	0.1009	0.3786	0.0489	0.1589✓	
0.2354	-0.2196	-0.1432	0.1101	0.0765	0.0024	-0.0072✓	
0.0072	0.0191	-0.0095	0.0049	0.0113	-0.0142	-0.0078✓	
0.0144	0.0064	-0.1672	0.0333	0.1339			
2 to 4	-0.3070	0.3622	-0.0828	0.1221	0.6692	0.2242✓	
0.1074	0.1021	-0.0147	-0.4450	-0.1168	-0.0087	0.0156✓	
-0.0103	-0.0204	0.0242	-0.0017	-0.0114	0.0187	0.0090✓	
-0.0259	-0.0098	0.1947	0.1130	-0.3077			
2 to 5	-0.0988	-0.0240	0.1843	0.1325	0.0747	0.2831✓	
0.1237	0.1506	-0.0087	0.2083	-0.1593	0.0038	-0.0039✓	
0.0001	-0.0048	-0.0077	-0.0038	-0.0033	0.0010	0.0015✓	
0.0040	0.0005	0.0304	-0.1155	0.0851			
2 to 6	-0.0665	-0.0128	0.1190	0.2942	0.0537	0.1856✓	
0.4670	-0.1087	0.1727	0.1319	0.2814	0.0027	-0.0060✓	
0.0049	0.0117	-0.0086	0.0023	0.0068	-0.0094	-0.0049✓	
0.0109	0.0045	-0.1057	-0.0088	0.1145			
3 to 5	-0.0582	-0.0189	0.1156	-0.2112	0.0393	0.1738✓	
-0.0836	0.3850	0.1276	0.1345	-0.2574	0.0021	0.0024✓	
-0.0069	-0.0239	0.0003	-0.0090	-0.0147	0.0149	0.0092✓	
-0.0093	-0.0057	0.1958	-0.1653	-0.0305			
3 to 6	0.0121	-0.0027	-0.0141	-0.3580	-0.0147	-0.0262✓	
0.3454	0.3317	0.7034	-0.0115	0.3717	-0.0006	0.0060✓	
-0.0082	-0.0243	0.0066	-0.0076	-0.0146	0.0167	0.0097✓	
-0.0142	-0.0071	0.2066	-0.1009	-0.1057			
4 to 5	0.0027	-0.1086	0.1589	0.0688	-0.1112	0.1562✓	
0.0659	0.0874	-0.0029	0.2675	-0.0903	0.0050	-0.0068✓	
0.0026	0.0015	-0.0118	-0.0024	0.0004	-0.0039	-0.0011✓	
0.0094	0.0028	-0.0259	-0.1149	0.1408			
5 to 6	0.0544	0.0155	-0.1049	0.0637	-0.0389	-0.1593✓	
0.1876	-0.2231	0.1239	-0.1204	0.3469	-0.0021	-0.0001✓	
0.0032	0.0126	0.0020	0.0053	0.0078	-0.0073	-0.0048✓	
0.0033	0.0025	-0.1008	0.1096	-0.0088			
7 to 8	0.0002	-0.0041	0.0059	0.0030	-0.0043	0.0057✓	
0.0027	0.0028	-0.0003	0.0101	-0.0031	0.4679	0.3183✓	
0.3207	-0.0676	-0.1496	-0.1472	-0.0636	-0.0796	0.0040✓	

0.0024	0.0835	0.0033	0.0681	-0.0714		
7 to 10	-0.0015	0.0063	-0.0073	-0.0090	0.0078	-0.0058✓
-0.0060	0.0032	0.0030	-0.0136	-0.0001	0.3183	0.4986✓
0.2746	-0.0137	0.1803	-0.0437	-0.0154	-0.0300	-0.0017✓
-0.2240	0.0283	-0.0626	-0.0521	0.1147		
7 to 11	0.0013	-0.0022	0.0013	0.0060	-0.0034	0.0001✓
0.0033	-0.0059	-0.0027	0.0035	0.0032	0.2138	0.1831✓
0.4047	0.0813	-0.0307	0.1909	0.0790	0.1096	-0.0022✓
0.2216	-0.1118	0.0593	-0.0160	-0.0433		
8 to 9	0.0045	-0.0037	-0.0012	0.0191	-0.0082	-0.0057✓
0.0094	-0.0248	-0.0097	0.0024	0.0151	-0.0541	-0.0109✓
0.0975	0.3704	0.0432	0.1516	0.2296	-0.2188	-0.1408✓
0.1084	0.0780	0.2152	-0.1304	-0.0848		
8 to 10	-0.0033	0.0209	-0.0264	-0.0239	0.0242	-0.0231✓
-0.0172	0.0007	0.0066	-0.0474	0.0059	-0.2992	0.3607✓
-0.0922	0.1079	0.6599	0.2070	0.0965	0.0991	-0.0114✓
-0.4529	-0.1105	-0.1318	-0.2404	0.3722		
8 to 11	0.0011	0.0006	-0.0026	0.0040	-0.0006	-0.0038✓
0.0015	-0.0078	-0.0025	-0.0032	0.0053	-0.0981	-0.0291✓
0.1909	0.1263	0.0690	0.2890	0.1215	0.1626	-0.0049✓
0.2200	-0.1675	0.0571	-0.0614	0.0044		
8 to 12	0.0034	-0.0023	-0.0016	0.0141	-0.0057	-0.0049✓
0.0068	-0.0190	-0.0073	0.0008	0.0117	-0.0636	-0.0154✓
0.1185	0.2870	0.0483	0.1822	0.4624	-0.1048	0.1754✓
0.1339	0.2802	0.1623	-0.1057	-0.0566		
9 to 11	-0.0030	0.0042	-0.0018	-0.0137	0.0072	0.0012✓
-0.0073	0.0149	0.0064	-0.0060	-0.0084	-0.0612	-0.0231✓
0.1265	-0.2104	0.0381	0.1877	-0.0806	0.3980	0.1297✓
0.1495	-0.2683	-0.1410	0.0545	0.0866		
9 to 12	-0.0045	0.0045	-0.0000	-0.0195	0.0090	0.0045✓
-0.0098	0.0240	0.0097	-0.0045	-0.0143	0.0079	-0.0035✓
-0.0067	-0.3520	-0.0114	-0.0147	0.3508	0.3373	0.7028✓
-0.0032	0.3654	-0.2134	0.1147	0.0987		
10 to 11	0.0017	-0.0048	0.0047	0.0090	-0.0065	0.0030✓
0.0054	-0.0060	-0.0036	0.0094	0.0025	0.0012	-0.1120✓
0.1662	0.0678	-0.1132	0.1650	0.0670	0.0972	-0.0008✓
0.2782	-0.0980	0.0758	0.0140	-0.0898		
11 to 12	0.0011	-0.0022	0.0016	0.0054	-0.0033	0.0005✓
0.0030	-0.0049	-0.0024	0.0037	0.0025	0.0557	0.0189✓
-0.1118	0.0650	-0.0368	-0.1675	0.1868	-0.2325	0.1218✓
-0.1307	0.3543	0.0511	-0.0090	-0.0421		
3 to 9	-0.0120	0.0124	-0.0006	-0.0523	0.0243	0.0114✓
-0.0264	0.0636	0.0258	-0.0130	-0.0378	0.0008	-0.0156✓
0.0222	0.0672	-0.0165	0.0214	0.0406	-0.0458	-0.0267✓
0.0379	0.0192	0.4304	0.2995	0.2701		
5 to 8	0.0055	0.0197	-0.0378	0.0104	0.0141	-0.0433✓
-0.0022	-0.0537	-0.0126	-0.0574	0.0411	0.0170	-0.0130✓
-0.0060	-0.0407	-0.0301	-0.0230	-0.0264	0.0177	0.0143✓
0.0070	-0.0034	0.2995	0.3940	0.3065		
4 to 10	0.0064	-0.0320	0.0384	0.0418	-0.0385	0.0319✓
0.0286	-0.0099	-0.0132	0.0704	-0.0033	-0.0179	0.0287✓

-0.0162	-0.0265	0.0465	0.0016	-0.0142	0.0281	0.0123✓
-0.0449	-0.0158	0.2701	0.3065	0.4234		

LINE OUTAGE DISTRIBUTION FACTOR (LODF) MATRIX  
Monitored            Outage of one circuit  
Line                    From - To

	1 to 2	1 to 4	1 to 5	2 to 3	2 to 4	2 to 5	2 to 6✓
to 6	3 to 5	3 to 6	4 to 5	5 to 6	7 to 8	7 to 10	7 to 11✓
8 to 9	8 to 10	8 to 11	8 to 12	9 to 11	9 to 12	10 to 11	11 to 12✓
12	3 to 9	5 to 8	4 to 10				
1 to 2	0.0000	0.6287	0.5344	-0.1168	-0.4640	-0.2067✓	
-0.1248	-0.1230	0.0204	0.0073	0.1250	0.0004	-0.0029✓	
0.0032	0.0089	-0.0049	0.0024	0.0063	-0.0065	-0.0075✓	
0.0047	0.0026	-0.0841	0.0365	0.0447			
1 to 4	0.5960	0.0000	0.4656	-0.0185	0.5474	-0.0503✓	
-0.0241	-0.0400	-0.0045	-0.2965	0.0356	-0.0078	0.0126✓	
-0.0055	-0.0073	0.0308	0.0013	-0.0043	0.0091	0.0076✓	
-0.0133	-0.0050	0.0868	0.1297	-0.2221			
1 to 5	0.4040	0.3713	0.0000	0.1353	-0.0834	0.2570✓	
0.1489	0.1629	-0.0159	0.2892	-0.1606	0.0074	-0.0097✓	
0.0023	-0.0016	-0.0259	-0.0037	-0.0019	-0.0026	-0.0000✓	
0.0086	0.0024	-0.0028	-0.1662	0.1774			
2 to 3	-0.1095	-0.0183	0.1677	0.0000	0.1477	0.2217✓	
0.4416	-0.3571	-0.4828	0.1503	0.1171	0.0044	-0.0143✓	
0.0121	0.0303	-0.0281	0.0068	0.0210	-0.0236	-0.0262✓	
0.0199	0.0100	-0.2936	0.0550	0.2322			
2 to 4	-0.5788	0.7204	-0.1376	0.1966	0.0000	0.3128✓	
0.2015	0.1660	-0.0497	-0.6074	-0.1789	-0.0163	0.0310✓	
-0.0173	-0.0324	0.0712	-0.0023	-0.0213	0.0311	0.0302✓	
-0.0359	-0.0151	0.3418	0.1865	-0.5337			
2 to 5	-0.1863	-0.0478	0.3064	0.2131	0.2260	0.0000✓	
0.2321	0.2449	-0.0295	0.2844	-0.2440	0.0072	-0.0077✓	
0.0001	-0.0076	-0.0227	-0.0053	-0.0061	0.0017	0.0050✓	
0.0055	0.0007	0.0533	-0.1906	0.1476			
2 to 6	-0.1254	-0.0255	0.1979	0.4735	0.1623	0.2588✓	
0.0000	-0.1767	0.5823	0.1800	0.4309	0.0050	-0.0119✓	
0.0083	0.0186	-0.0253	0.0032	0.0127	-0.0157	-0.0165✓	
0.0151	0.0070	-0.1856	-0.0145	0.1986			
3 to 5	-0.1097	-0.0376	0.1922	-0.3399	0.1187	0.2424✓	
-0.1568	0.0000	0.4302	0.1836	-0.3941	0.0040	0.0048✓	
-0.0115	-0.0379	0.0008	-0.0127	-0.0273	0.0247	0.0310✓	
-0.0129	-0.0088	0.3438	-0.2728	-0.0529			
3 to 6	0.0228	-0.0053	-0.0235	-0.5760	-0.0446	-0.0366✓	
0.6481	0.5394	0.0000	-0.0157	0.5691	-0.0011	0.0120✓	
-0.0137	-0.0386	0.0195	-0.0106	-0.0272	0.0278	0.0325✓	
-0.0197	-0.0109	0.3627	-0.1665	-0.1833			
4 to 5	0.0050	-0.2160	0.2642	0.1107	-0.3363	0.2179✓	
0.1237	0.1422	-0.0097	0.0000	-0.1383	0.0095	-0.0136✓	

0.0044	0.0024	-0.0348	-0.0034	0.0007	-0.0065	-0.0038✓
0.0131	0.0043	-0.0455	-0.1895	0.2442		
5 to 6	0.1026	0.0308	-0.1744	0.1025	-0.1177	-0.2223✓
0.3519	-0.3627	0.4177	-0.1644	0.0000	-0.0039	-0.0002✓
0.0054	0.0200	0.0058	0.0074	0.0146	-0.0121	-0.0160✓
0.0046	0.0039	-0.1770	0.1809	-0.0153		
7 to 8	0.0004	-0.0082	0.0099	0.0048	-0.0131	0.0080✓
0.0050	0.0045	-0.0010	0.0138	-0.0047	0.0000	0.6348✓
0.5387	-0.1074	-0.4399	-0.2070	-0.1184	-0.1322	0.0134✓
0.0034	0.1294	0.0058	0.1124	-0.1239		
7 to 10	-0.0028	0.0126	-0.0121	-0.0144	0.0235	-0.0081✓
-0.0112	0.0051	0.0102	-0.0186	-0.0002	0.5982	0.0000✓
0.4613	-0.0217	0.5303	-0.0614	-0.0286	-0.0499	-0.0058✓
-0.3104	0.0438	-0.1099	-0.0859	0.1989		
7 to 11	0.0024	-0.0043	0.0022	0.0097	-0.0104	0.0001✓
0.0062	-0.0097	-0.0092	0.0048	0.0049	0.4018	0.3652✓
0.0000	0.1291	-0.0904	0.2684	0.1470	0.1821	-0.0075✓
0.3070	-0.1732	0.1041	-0.0265	-0.0750		
8 to 9	0.0085	-0.0073	-0.0021	0.0307	-0.0247	-0.0080✓
0.0176	-0.0404	-0.0328	0.0033	0.0231	-0.1017	-0.0218✓
0.1638	0.0000	0.1269	0.2132	0.4271	-0.3635	-0.4737✓
0.1502	0.1208	0.3778	-0.2152	-0.1471		
8 to 10	-0.0062	0.0416	-0.0439	-0.0384	0.0732	-0.0323✓
-0.0323	0.0012	0.0224	-0.0646	0.0091	-0.5623	0.7194✓
-0.1549	0.1714	0.0000	0.2912	0.1795	0.1646	-0.0384✓
-0.6275	-0.1712	-0.2313	-0.3967	0.6454		
8 to 11	0.0022	0.0012	-0.0043	0.0065	-0.0017	-0.0052✓
0.0029	-0.0127	-0.0085	-0.0044	0.0081	-0.1844	-0.0581✓
0.3206	0.2007	0.2029	0.0000	0.2259	0.2702	-0.0164✓
0.3048	-0.2595	0.1002	-0.1014	0.0076		
8 to 12	0.0064	-0.0046	-0.0026	0.0227	-0.0173	-0.0069✓
0.0128	-0.0310	-0.0247	0.0011	0.0180	-0.1196	-0.0307✓
0.1991	0.4558	0.1419	0.2562	0.0000	-0.1741	0.5901✓
0.1855	0.4340	0.2849	-0.1744	-0.0982		
9 to 11	-0.0057	0.0084	-0.0030	-0.0220	0.0218	0.0016✓
-0.0136	0.0242	0.0217	-0.0082	-0.0129	-0.1150	-0.0461✓
0.2124	-0.3341	0.1121	0.2639	-0.1500	0.0000	0.4365✓
0.2072	-0.4155	-0.2476	0.0899	0.1501		
9 to 12	-0.0084	0.0089	-0.0000	-0.0314	0.0271	0.0062✓
-0.0184	0.0389	0.0326	-0.0061	-0.0219	0.0149	-0.0069✓
-0.0113	-0.5591	-0.0336	-0.0206	0.6525	0.5604	0.0000✓
-0.0045	0.5660	-0.3746	0.1892	0.1712		
10 to 11	0.0032	-0.0095	0.0077	0.0145	-0.0196	0.0041✓
0.0102	-0.0098	-0.0120	0.0129	0.0038	0.0023	-0.2234✓
0.2792	0.1076	-0.3329	0.2320	0.1246	0.1615	-0.0027✓
0.0000	-0.1518	0.1330	0.0231	-0.1557		
11 to 12	0.0021	-0.0043	0.0026	0.0086	-0.0098	0.0007✓
0.0057	-0.0080	-0.0079	0.0051	0.0039	0.1047	0.0376✓
-0.1878	0.1032	-0.1083	-0.2356	0.3475	-0.3863	0.4099✓
-0.1811	0.0000	0.0897	-0.0148	-0.0730		
3 to 9	-0.0226	0.0246	-0.0010	-0.0841	0.0736	0.0159✓

-0.0496	0.1035	0.0871	-0.0177	-0.0579	0.0015	-0.0312✓
0.0373	0.1068	-0.0484	0.0301	0.0755	-0.0761	-0.0897✓
0.0525	0.0297	0.0000	0.4942	0.4684		
5 to 8	0.0104	0.0391	-0.0628	0.0168	0.0427	-0.0604✓
-0.0041	-0.0874	-0.0425	-0.0784	0.0630	0.0320	-0.0260✓
-0.0101	-0.0647	-0.0884	-0.0324	-0.0491	0.0294	0.0482✓
0.0097	-0.0052	0.5258	0.0000	0.5316		
4 to 10	0.0121	-0.0637	0.0638	0.0673	-0.1163	0.0445✓
0.0537	-0.0161	-0.0445	0.0961	-0.0051	-0.0336	0.0572✓
-0.0272	-0.0421	0.1368	0.0023	-0.0263	0.0467	0.0415✓
-0.0622	-0.0245	0.4742	0.5058	0.0000		

```
Elapsed time is 0.106524 seconds.
>> PTDF_for_any_bus_to_bus
Enter the bus number where power is being injected: 1
Enter the bus number where power is being removed: 3
Warning: Self connecting nodes are not allowed, ignoring the diagonal of CM.
> In biograph (line 158)
    In PTDF_for_any_bus_to_bus (line 37)
```

Distance from bus 1 to bus 3 is: 2

Path from bus 1 to bus 3 is:  
1 2 3

POWER TRANSFER DISTRIBUTION FACTOR (PTDF) VECTOR

Monitored	Transaction
Line	From(Sell) - To(Buy)

	1 to 3
1 to 2	0.3970
1 to 4	0.3046
1 to 5	0.2984
2 to 3	0.3205
2 to 4	-0.1849
2 to 5	0.0337
2 to 6	0.2277
3 to 5	-0.2694
3 to 6	-0.3459
4 to 5	0.0715
5 to 6	0.1182
7 to 8	0.0031
7 to 10	-0.0104
7 to 11	0.0073
8 to 9	0.0236
8 to 10	-0.0272
8 to 11	0.0052
8 to 12	0.0175
9 to 11	-0.0167



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```
9 to 12      -0.0240
10 to 11      0.0107
11 to 12      0.0065
3 to 9        -0.0642
5 to 8         0.0159
4 to 10        0.0483
>>
```