

APPENDIX E

Load flow result using fast decouple method for IEEE 30-bus test system

| Bus. | Volts pu | Angle deg. | PG (Mw) | QG (Mvar) | PL (Mw) | QL (Mvar) |
|------|-------------|---------------|------------|--------------|------------|--------------|
| 1 | 1.0600 | 0.0000 | 260.9793 | -21.2605 | 0.0000 | 0.0000 |
| 2 | 1.0450 | -5.5257 | 40.0000 | 55.1099 | 21.7000 | 12.7000 |
| 3 | 1.0227 | -8.0103 | 0.0000 | 0.0000 | 2.4000 | 1.2000 |
| 4 | 1.0143 | -9.6681 | 0.0000 | 0.0000 | 7.6000 | 1.6000 |
| 5 | 1.0100 | -14.3687 | 0.0000 | 34.9592 | 94.2000 | 19.0000 |
| 6 | 1.0119 | -11.3805 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 7 | 1.0034 | -13.1343 | 0.0000 | 0.0000 | 22.8000 | 10.9000 |
| 8 | 1.0100 | -12.1006 | 0.0000 | 32.4068 | 30.0000 | 30.0000 |
| 9 | 1.0519 | -14.4267 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 10 | 1.0461 | -16.0195 | 0.0000 | 0.0000 | 5.8000 | 2.0000 |
| 11 | 1.0820 | -14.4267 | 0.0000 | 15.6829 | 0.0000 | 0.0000 |
| 12 | 1.0582 | -15.2885 | 0.0000 | 0.0000 | 11.2000 | 7.5000 |
| 13 | 1.0710 | -15.2885 | 0.0000 | 9.7769 | 0.0000 | 0.0000 |
| 14 | 1.0434 | -16.1764 | 0.0000 | 0.0000 | 6.2000 | 1.6000 |
| 15 | 1.0388 | -16.2649 | 0.0000 | 0.0000 | 8.2000 | 2.5000 |
| 16 | 1.0459 | -15.8707 | 0.0000 | 0.0000 | 3.5000 | 1.8000 |
| 17 | 1.0408 | -16.1818 | 0.0000 | 0.0000 | 9.0000 | 5.8000 |
| 18 | 1.0293 | -16.8719 | 0.0000 | 0.0000 | 3.2000 | 0.9000 |
| 19 | 1.0267 | -17.0416 | 0.0000 | 0.0000 | 9.5000 | 3.4000 |
| 20 | 1.0308 | -16.8433 | 0.0000 | 0.0000 | 2.2000 | 0.7000 |
| 21 | 1.0338 | -16.4620 | 0.0000 | 0.0000 | 17.5000 | 11.2000 |
| 22 | 1.0343 | -16.4480 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23 | 1.0283 | -16.6487 | 0.0000 | 0.0000 | 3.2000 | 1.6000 |
| 24 | 1.0227 | -16.8165 | 0.0000 | 0.0000 | 8.7000 | 6.7000 |
| 25 | 1.0186 | -16.3820 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 1.0009 | -16.8007 | 0.0000 | 0.0000 | 3.5000 | 2.3000 |
| 27 | 1.0246 | -15.8539 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | 1.0081 | -11.9983 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 29 | 1.0048 | -17.0812 | 0.0000 | 0.0000 | 2.4000 | 0.9000 |
| 30 | 0.9933 | -17.9621 | 0.0000 | 0.0000 | 10.6000 | 1.9000 |

| From Bus.i | To Bus.j | Pij (MW) | Pji (MW) | Qij (MVar) | Qji (MVar) |
|------------|----------|----------|-----------|------------|------------|
| 1 | 2 | 177.8009 | -172.3103 | -26.3092 | 30.2999 |
| 1 | 3 | 83.1783 | -80.3767 | 2.6050 | -0.6237 |
| 2 | 4 | 45.7235 | -44.6188 | 1.2462 | -6.0626 |
| 3 | 4 | 77.9752 | -77.2064 | -3.8665 | 4.1321 |
| 2 | 5 | 82.9738 | -79.9872 | 0.6326 | 2.4753 |
| 2 | 6 | 61.9179 | -59.8753 | -1.5576 | -0.7266 |
| 4 | 6 | 70.1920 | -69.6012 | -22.4301 | 5.9660 |
| 5 | 7 | -14.2102 | 14.3619 | 9.4964 | -13.2065 |
| 6 | 7 | 37.5296 | -37.1621 | -2.7737 | 0.3560 |
| 6 | 8 | 29.5526 | -29.4487 | -4.3998 | 2.9081 |
| 6 | 9 | 27.7923 | -27.7923 | -19.1119 | 21.3718 |
| 6 | 10 | 15.8840 | -15.8840 | -5.7808 | 7.2840 |
| 9 | 11 | 0.0000 | 0.0000 | -15.2459 | 15.6829 |
| 9 | 10 | 27.7916 | -27.7916 | 5.8395 | -5.0377 |
| 4 | 12 | 44.0350 | -44.0350 | -16.5266 | 21.6574 |
| 12 | 13 | 0.0000 | 0.0000 | -9.6603 | 9.7769 |
| 12 | 14 | 7.8434 | -7.7694 | 2.5222 | -2.4034 |
| 12 | 15 | 17.8262 | -17.6108 | 7.0483 | -6.7263 |
| 12 | 16 | 7.1657 | -7.1139 | 3.2694 | -3.1848 |
| 14 | 15 | 1.5686 | -1.5627 | 0.6754 | -0.6718 |
| 16 | 17 | 3.6138 | 3.6028 | 1.3076 | -1.2871 |
| 15 | 18 | 5.9814 | -5.9432 | 1.6878 | -1.6283 |
| 18 | 19 | 2.7431 | -2.7383 | 0.6768 | -0.6694 |
| 19 | 20 | -6.7617 | 6.7789 | -2.8223 | 2.8484 |
| 10 | 20 | 9.0606 | -8.9788 | 3.7575 | -3.6143 |
| 10 | 17 | 5.4120 | -5.3971 | 4.6484 | -4.6155 |
| 10 | 21 | 15.7861 | -15.6752 | 10.1250 | -9.9349 |
| 10 | 22 | 7.6185 | -7.5660 | 4.6540 | -4.5689 |
| 21 | 22 | -1.8249 | 1.8255 | -1.4676 | 1.4686 |
| 15 | 23 | 4.9921 | -4.9610 | 2.9712 | -2.9222 |
| 22 | 24 | 5.7403 | -5.6951 | 3.0597 | -3.0082 |
| 23 | 24 | 1.7609 | -1.7551 | 1.2797 | -1.2700 |
| 24 | 25 | -1.2500 | 1.2600 | 1.9873 | -1.9656 |
| 25 | 26 | 3.5442 | -3.4996 | 2.3673 | -2.3165 |
| 25 | 27 | -4.8045 | 4.8289 | -0.4232 | 0.4591 |
| 28 | 27 | 18.1096 | -18.1096 | -3.7191 | 5.0082 |
| 27 | 29 | 6.1896 | -6.1036 | 1.6787 | -1.5583 |
| 27 | 30 | 7.0918 | -6.9299 | 1.6448 | -1.4192 |
| 29 | 30 | 3.7038 | -3.6703 | 0.5963 | -0.5491 |
| 8 | 28 | -0.5505 | 0.5515 | -3.2408 | -5.4714 |
| 6 | 28 | 18.7180 | -18.6599 | -0.0010 | -2.4635 |