# Appendix C

# Data for the IEEE 57 bus Power System

The IEEE 57 bus Power System [174], as shown in Fig.C.1, is used in the thesis for different simulations conducted in Chapter 3. The bus data and transmission line data are given at 100 MVA in Table C.1 and Table C.2 respectively.

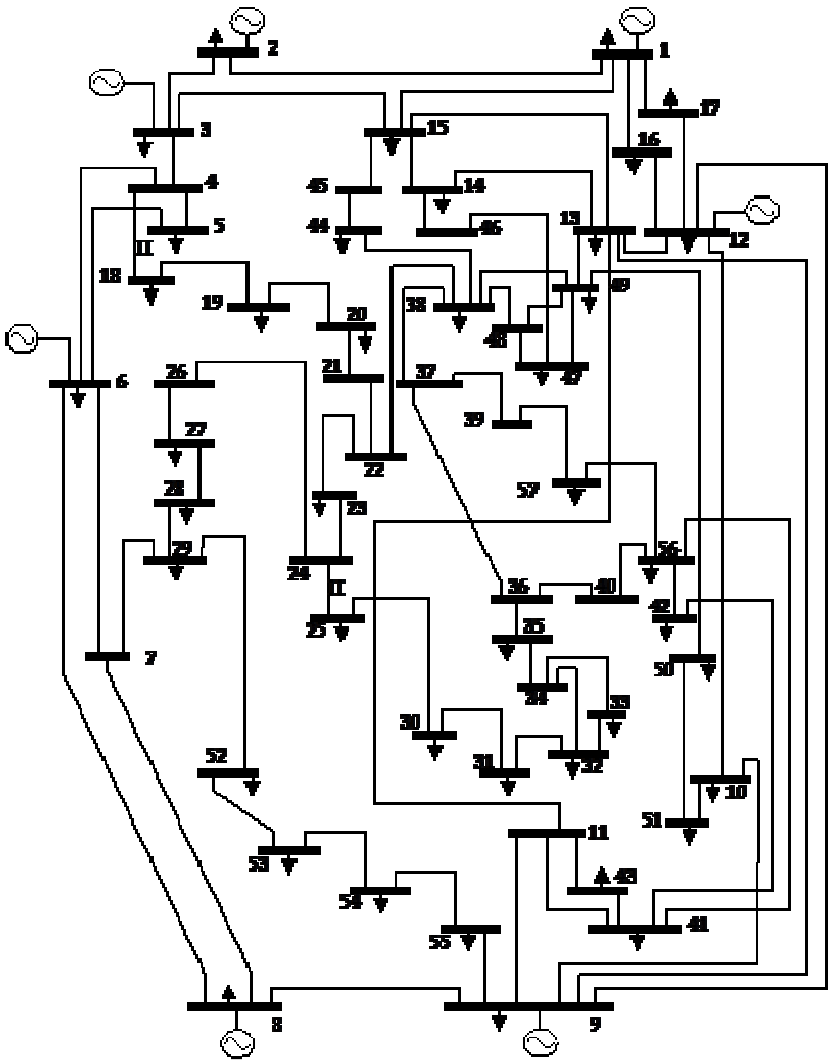

**Fig.C.1:** Single line diagram of the IEEE 57 bus Power System

**Table C.1:** Bus data for the IEEE 57 bus Power System (in p.u.)

| Bus No. | $P_{G,i}$ | $P_{D,i}$ | $Q_{D,i}$ | $V_i$ | $V_i^{max}$ | $V_i^{min}$ |
|---|---|---|---|---|---|---|
| 1 | 4.7926 | 0.5500 | 0.1700 | 1.0400 | 1.10 | 0.90 |
| 2 | 0.0000 | 0.0300 | 0.8800 | 1.0100 | 1.10 | 0.90 |
| 3 | 0.4000 | 0.4100 | 0.2100 | 0.9850 | 1.10 | 0.90 |
| 4 | 0.0000 | 0.0000 | 0.0000 | 0.9783 | 1.06 | 0.94 |
| 5 | 0.0000 | 0.1300 | 0.0400 | 0.9757 | 1.06 | 0.94 |
| 6 | 0.0000 | 0.7500 | 0.0200 | 0.9800 | 1.10 | 0.90 |
| 7 | 0.0000 | 0.0000 | 0.0000 | 0.9819 | 1.06 | 0.94 |
| 8 | 4.5000 | 1.5000 | 0.2200 | 1.0050 | 1.10 | 0.90 |
| 9 | 0.0000 | 1.2100 | 0.2600 | 0.9800 | 1.06 | 0.94 |
| 10 | 0.0000 | 0.0500 | 0.0200 | 0.9857 | 1.10 | 0.90 |
| 11 | 0.0000 | 0.0000 | 0.0000 | 0.9732 | 1.06 | 0.94 |
| 12 | 3.1000 | 3.7700 | 0.2400 | 1.0150 | 1.10 | 0.90 |
| 13 | 0.0000 | 0.1800 | 0.0230 | 0.9779 | 1.06 | 0.94 |
| 14 | 0.0000 | 0.1050 | 0.0530 | 0.9688 | 1.06 | 0.94 |
| 15 | 0.0000 | 0.2200 | 0.0500 | 0.9871 | 1.06 | 0.94 |
| 16 | 0.0000 | 0.4300 | 0.0300 | 1.0133 | 1.06 | 0.94 |
| 17 | 0.0000 | 0.4200 | 0.0800 | 1.0174 | 1.06 | 0.94 |
| 18 | 0.0000 | 0.2720 | 0.0980 | 0.9751 | 1.06 | 0.94 |
| 19 | 0.0000 | 0.0330 | 0.0060 | 0.9515 | 1.06 | 0.94 |
| 20 | 0.0000 | 0.0230 | 0.0100 | 0.9497 | 1.06 | 0.94 |
| 21 | 0.0000 | 0.0000 | 0.0000 | 1.0004 | 1.06 | 0.94 |
| 22 | 0.0000 | 0.0000 | 0.0000 | 1.0029 | 1.06 | 0.94 |
| 23 | 0.0000 | 0.0630 | 0.0210 | 1.0010 | 1.06 | 0.94 |
| 24 | 0.0000 | 0.0000 | 0.0000 | 0.9842 | 1.06 | 0.94 |
| 25 | 0.0000 | 0.0630 | 0.0320 | 0.9378 | 1.06 | 0.94 |
| 26 | 0.0000 | 0.0000 | 0.0000 | 0.9453 | 1.06 | 0.94 |
| 27 | 0.0000 | 0.0930 | 0.0050 | 0.9727 | 1.06 | 0.94 |
| 28 | 0.0000 | 0.0460 | 0.0230 | 0.9896 | 1.06 | 0.94 |
| 29 | 0.0000 | 0.1700 | 0.0260 | 1.0043 | 1.06 | 0.94 |
| 30 | 0.0000 | 0.0360 | 0.0180 | 0.9201 | 1.06 | 0.94 |
| 31 | 0.0000 | 0.0580 | 0.0290 | 0.8999 | 1.06 | 0.94 |
| 32 | 0.0000 | 0.0160 | 0.0080 | 0.9259 | 1.06 | 0.94 |
| 33 | 0.0000 | 0.0380 | 0.0190 | 0.9236 | 1.06 | 0.94 |
| 34 | 0.0000 | 0.0000 | 0.0000 | 0.9491 | 1.06 | 0.94 |
| 35 | 0.0000 | 0.0600 | 0.0300 | 0.9575 | 1.06 | 0.94 |
| 36 | 0.0000 | 0.0000 | 0.0000 | 0.9682 | 1.06 | 0.94 |
| 37 | 0.0000 | 0.0000 | 0.0000 | 0.9778 | 1.06 | 0.94 |
| 38 | 0.0000 | 0.1400 | 0.0700 | 1.0071 | 1.06 | 0.94 |
| 39 | 0.0000 | 0.0000 | 0.0000 | 0.9758 | 1.06 | 0.94 |
| 40 | 0.0000 | 0.0000 | 0.0000 | 0.9653 | 1.06 | 0.94 |
| 41 | 0.0000 | 0.0630 | 0.0300 | 0.9938 | 1.06 | 0.94 |
| 42 | 0.0000 | 0.0710 | 0.0440 | 0.9631 | 1.06 | 0.94 |
| 43 | 0.0000 | 0.0200 | 0.0100 | 1.0083 | 1.06 | 0.94 |
| 44 | 0.0000 | 0.1200 | 0.0180 | 1.0121 | 1.06 | 0.94 |
| 45 | 0.0000 | 0.0000 | 0.0000 | 1.0334 | 1.06 | 0.94 |
| 46 | 0.0000 | 0.0000 | 0.0000 | 1.0570 | 1.06 | 0.94 |
| 47 | 0.0000 | 0.2970 | 0.1160 | 1.0292 | 1.06 | 0.94 |
| 48 | 0.0000 | 0.0000 | 0.0000 | 1.0229 | 1.06 | 0.94 |
| 49 | 0.0000 | 0.1800 | 0.0850 | 1.0328 | 1.06 | 0.94 |
| 50 | 0.0000 | 0.2100 | 0.1050 | 1.0207 | 1.06 | 0.94 |
| 51 | 0.0000 | 0.1800 | 0.0530 | 1.0513 | 1.06 | 0.94 |
| 52 | 0.0000 | 0.0490 | 0.0220 | 0.9676 | 1.06 | 0.94 |
| 53 | 0.0000 | 0.2000 | 0.1000 | 0.9546 | 1.06 | 0.94 |
| 54 | 0.0000 | 0.0410 | 0.0140 | 0.9866 | 1.06 | 0.94 |
| 55 | 0.0000 | 0.0680 | 0.0340 | 1.0276 | 1.06 | 0.94 |
| 56 | 0.0000 | 0.0760 | 0.0220 | 0.9641 | 1.06 | 0.94 |
| 57 | 0.0000 | 0.0670 | 0.0200 | 0.9600 | 1.06 | 0.94 |

**Table C.2:** Transmission line data for the IEEE 57 bus Power System (in p.u.)

| Line No. | From Bus No. | To Bus No. | R | X | $B_{ch}$ (Full) | Max. Line Rating |
|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 0.0083 | 0.0280 | 0.1290 | 99.00 |
| 2 | 2 | 3 | 0.0298 | 0.0850 | 0.0818 | 99.00 |
| 3 | 3 | 4 | 0.0112 | 0.0366 | 0.0380 | 99.00 |
| 4 | 4 | 5 | 0.0625 | 0.1320 | 0.0258 | 99.00 |
| 5 | 4 | 6 | 0.0430 | 0.1480 | 0.0348 | 99.00 |
| 6 | 6 | 7 | 0.0200 | 0.1020 | 0.0276 | 99.00 |
| 7 | 6 | 8 | 0.0339 | 0.1730 | 0.0470 | 99.00 |
| 8 | 8 | 9 | 0.0099 | 0.0505 | 0.0548 | 99.00 |
| 9 | 9 | 10 | 0.0369 | 0.1679 | 0.0440 | 99.00 |
| 10 | 9 | 11 | 0.0258 | 0.0848 | 0.0218 | 99.00 |
| 11 | 9 | 12 | 0.0648 | 0.2950 | 0.0772 | 99.00 |
| 12 | 9 | 13 | 0.0481 | 0.1580 | 0.0406 | 99.00 |
| 13 | 13 | 14 | 0.0132 | 0.0434 | 0.0110 | 99.00 |
| 14 | 13 | 15 | 0.0269 | 0.0869 | 0.0230 | 99.00 |
| 15 | 1 | 15 | 0.0178 | 0.0910 | 0.0988 | 99.00 |
| 16 | 1 | 16 | 0.0454 | 0.2060 | 0.0546 | 99.00 |
| 17 | 1 | 17 | 0.0238 | 0.1080 | 0.0286 | 99.00 |
| 18 | 3 | 15 | 0.0162 | 0.0530 | 0.0544 | 99.00 |
| 19 | 4 | 18 | 0.0000 | 0.5550 | 0.0000 | 99.00 |
| 20 | 4 | 18 | 0.0000 | 0.4300 | 0.0000 | 99.00 |
| 21 | 5 | 6 | 0.0302 | 0.0641 | 0.0124 | 99.00 |
| 22 | 7 | 8 | 0.0139 | 0.0712 | 0.0194 | 99.00 |
| 23 | 10 | 12 | 0.0277 | 0.1262 | 0.0328 | 99.00 |
| 24 | 11 | 13 | 0.0223 | 0.0732 | 0.0188 | 99.00 |
| 25 | 12 | 13 | 0.0178 | 0.0580 | 0.0604 | 99.00 |
| 26 | 12 | 16 | 0.0180 | 0.0813 | 0.0216 | 99.00 |
| 27 | 12 | 17 | 0.0397 | 0.1790 | 0.0476 | 99.00 |
| 28 | 14 | 15 | 0.0171 | 0.0547 | 0.0148 | 99.00 |
| 29 | 18 | 19 | 0.4610 | 0.6850 | 0.0000 | 99.00 |
| 30 | 19 | 20 | 0.2830 | 0.4340 | 0.0000 | 99.00 |
| 31 | 21 | 20 | 0.0000 | 0.7767 | 0.0000 | 99.00 |
| 32 | 21 | 22 | 0.0736 | 0.1170 | 0.0000 | 99.00 |
| 33 | 22 | 23 | 0.0099 | 0.0152 | 0.0000 | 99.00 |
| 34 | 23 | 24 | 0.1660 | 0.2560 | 0.0084 | 99.00 |
| 35 | 24 | 25 | 0.0000 | 1.1820 | 0.0000 | 99.00 |
| 36 | 24 | 25 | 0.0000 | 1.2300 | 0.0000 | 99.00 |
| 37 | 24 | 26 | 0.0000 | 0.0473 | 0.0000 | 99.00 |
| 38 | 26 | 27 | 0.1650 | 0.2540 | 0.0000 | 99.00 |
| 39 | 27 | 28 | 0.0618 | 0.0954 | 0.0000 | 99.00 |
| 40 | 28 | 29 | 0.0418 | 0.0587 | 0.0000 | 99.00 |
| 41 | 7 | 29 | 0.0000 | 0.0648 | 0.0000 | 99.00 |
| 42 | 25 | 30 | 0.1350 | 0.2020 | 0.0000 | 99.00 |
| 43 | 30 | 31 | 0.3260 | 0.4970 | 0.0000 | 99.00 |
| 44 | 31 | 32 | 0.5070 | 0.7550 | 0.0000 | 99.00 |
| 45 | 32 | 33 | 0.0392 | 0.0360 | 0.0000 | 99.00 |
| 46 | 34 | 32 | 0.0000 | 0.9530 | 0.0000 | 99.00 |
| 47 | 34 | 35 | 0.0520 | 0.0780 | 0.0032 | 99.00 |
| 48 | 35 | 36 | 0.0430 | 0.0537 | 0.0016 | 99.00 |
| 49 | 36 | 37 | 0.0290 | 0.0366 | 0.0000 | 99.00 |
| 50 | 37 | 38 | 0.0651 | 0.1009 | 0.0020 | 99.00 |
| 51 | 37 | 39 | 0.0239 | 0.0379 | 0.0000 | 99.00 |
| 52 | 36 | 40 | 0.0300 | 0.0466 | 0.0000 | 99.00 |

*Table C.2 Contd…*

*Table C.2 Contd…*

| | | | | | | |
|---|---|---|---|---|---|---|
| 53 | 22 | 38 | 0.0192 | 0.0295 | 0.0000 | 99.00 |
| 54 | 11 | 41 | 0.0000 | 0.7490 | 0.0000 | 99.00 |
| 55 | 41 | 42 | 0.2070 | 0.3520 | 0.0000 | 99.00 |
| 56 | 41 | 43 | 0.0000 | 0.4120 | 0.0000 | 99.00 |
| 57 | 38 | 44 | 0.0289 | 0.0585 | 0.0020 | 99.00 |
| 58 | 15 | 45 | 0.0000 | 0.1042 | 0.0000 | 99.00 |
| 59 | 14 | 46 | 0.0000 | 0.0735 | 0.0000 | 99.00 |
| 60 | 46 | 47 | 0.0230 | 0.0680 | 0.0032 | 99.00 |
| 61 | 47 | 48 | 0.0182 | 0.0233 | 0.0000 | 99.00 |
| 62 | 48 | 49 | 0.0834 | 0.1290 | 0.0048 | 99.00 |
| 63 | 49 | 50 | 0.0801 | 0.1280 | 0.0000 | 99.00 |
| 64 | 50 | 51 | 0.1386 | 0.2200 | 0.0000 | 99.00 |
| 65 | 10 | 51 | 0.0000 | 0.0712 | 0.0000 | 99.00 |
| 66 | 13 | 49 | 0.0000 | 0.1910 | 0.0000 | 99.00 |
| 67 | 29 | 52 | 0.1442 | 0.1870 | 0.0000 | 99.00 |
| 68 | 52 | 53 | 0.0762 | 0.0984 | 0.0000 | 99.00 |
| 69 | 53 | 54 | 0.1878 | 0.2320 | 0.0000 | 99.00 |
| 70 | 54 | 55 | 0.1732 | 0.2265 | 0.0000 | 99.00 |
| 71 | 11 | 43 | 0.0000 | 0.1530 | 0.0000 | 99.00 |
| 72 | 44 | 45 | 0.0624 | 0.1242 | 0.0040 | 99.00 |
| 73 | 40 | 56 | 0.0000 | 1.1950 | 0.0000 | 99.00 |
| 74 | 56 | 41 | 0.5530 | 0.5490 | 0.0000 | 99.00 |
| 75 | 56 | 42 | 0.2125 | 0.3540 | 0.0000 | 99.00 |
| 76 | 39 | 57 | 0.0000 | 1.3550 | 0.0000 | 99.00 |
| 77 | 57 | 56 | 0.1740 | 0.2600 | 0.0000 | 99.00 |
| 78 | 38 | 49 | 0.1150 | 0.1770 | 0.0030 | 99.00 |
| 79 | 38 | 48 | 0.0312 | 0.0482 | 0.0000 | 99.00 |
| 80 | 9 | 55 | 0.0000 | 0.1205 | 0.0000 | 99.00 |