DAFTAR PUSTAKA

Abdelsalam A. Eajal & M.E. El-Hawary, 2010, "*Optimal Capacitor Placement and Sizing in Unbalance Distribution System with Harmonic Consideration Using Particle Swarm Optimization*", IEEE Transaction on Power Delivery, Vol. 25, No. 3, pp. 1734-1741

B. Peng, L. Liu and J. Wang, "Design of harmonic control and reactive power compensation scheme in a pipe fitting factory," 2021 China International Conference on Electricity Distribution (CICED), Shanghai, China, 2021, pp. 107-110, doi: 10.1109/CICED50259.2021.9556833

C. Sankaran, 2002, "*Power Quality*". United States of America: CRC.

Denyal, A., Penangsang, O., Asfani, D. A., 2013, "Pemodelan Sistem Distribusi Radial Untuk Studi Aliran Daya Harmonisa Tiga Fasa", Jurnal Teknik POMITS Vol. 1 No. 1. Pp 1-6

D.V. Yamille, V.S.G. Kumar & R.G. Harley, 2008, "*Particle Swarm Optimization: Basic Concepts, Variants and Applications in Power System*", Institute of Electrical and Electronic Engineers (IEEE)

E.F. Fauchs, M.A.S., 2008, "*Power Quality in Power System and Electrical Mechine*", Elsevier

Faraby, M. D., Pengangsang, O., 2018, *"Impact Optimal DG Placement Against Harmonic Distribution on Reconfiguration Network on Microgrid System"*, The 2nd EPI International Conference Science and Engineering 2018, Universitas Hasanuddin, Makassar.

F. Haz, G. A. Setia, Yusran, S. M. Said and H. R. Iskandar, "The Optimization of SVC Placement in Sulselbar Transmission System Using Inertia Weight Particle Swarm Optimization," 2019 2nd International Conference on High Voltage Engineering and Power Systems (ICHVEPS), Denpasar, Indonesia, 2019, pp. 1-6, doi: 10.1109/ICHVEPS47643.2019.9011127

Faraby, M. D., O. Penangsang, R.S. Wibowo, A. Fitriati, Coordinated Planning in Improving Power Quality Considering the Use of non-Linear Load in Radial Distribution System," *International Journal of Electrical and Computer Engineering*, Vol. 11, No. 6, pp. 4610-4621, 2021, doi: 10.11591/ijece.v11i6.pp4610-4621

J.H. Teng & C.Y. Chang, 2007, "*Backward/Forward-Based Harmonic Analysis Method for Distribution System*", IEEE Transaction on Power Delivery Vol. 22, No. 3, pp. 1665-1671

., M. Todorovski, 2016, "*Optimal Capacitor Placement in Distorted Distribution Network with different load models using Penalty Free*

Genetic Algorithm", Elsevier, Journal Electric Power and Energy System, pp. 174182

K. Vinodhkumar & B. Sravankumar, 2015, "*PSO based Optimal Power Flow for Optimal Placement and Sizing of Static VAR Compensator*", International Journal of Research and Development Organization (IJRD)

K. James & E. Russel, 1995, "*Particle Swarm Optimization*" Institute of Electrical and Electronic Engineers (IEEE) pp. 1942-1948

M.S.S Azevedo, I.G. Abril & J.C. Laite, 2016, "*Capacitor Placement by NSGA-II in Distribution System with non-Linear Loads*", Elsevier, Journal Electric Power and Energy System, pp. 281-287

N. Van Minh, "Qualitfication and Optimization of the Capacior Position for Distribution Network with Harmonics by genetic Algorith," 2022 7th National Scientific Conference on Applying New Technology in Green Buildings (ATiGB), Da Nang, Vietnam, 2022, pp. 161-165, doi: 10.1109/ATiGB56486.2022.9984077

N. Locci, C. Muscas, S.Sulis, 2007, "*On the Measurements on Power Quality Indexes for Harmonic Distortion in the Presence of Capacitor*", IEEE Transaction on Instrument and Measurement 56

P. Bagheri, W. Xu, T.Ding, 2016, "*A Distributed Filtering Scheme to Mitigate Harmonics in Residential Distribution System*", IEEE Transaction Power Delivery (31) 2 pp. 648-656

P. Kgori, D. E. Okojie and U. B. Akuru, "Design and Analysis of a Proposed Multistage Capacitor Bank Compensation Scheme," 2022 IEEE PES/IAS PowerAfrica, Kigali, Rwanda, 2022, pp. 1-5, doi: 10.1109/PowerAfrica53997.2022.9905307

R. S. Wibowo, "Rekonfigurasi Jaringan Distribusi Primer PT. PLN (Persero) ULP Giri Menggunakan *Binary Particle Swarm Optimization* untuk Mengurangi Rugi - Rugi Daya Jaringan Distribusi," 2020

Rizkytama, A., Penagsang, O., Soeprijanto, A., 2009, "Perencanaan *High Pass* dan *Single Tuned Filter* sebagai Filter Harmonisa Pada Sistem Kelistrikan Tabang Coal Upgrading Plant (TCUP) Kalimantan Timur", Skripsi Teknik Elektro ITS, Surabaya

Suyanto, Penangsang, O., Soeprijanto, A., 2018, *"Decision Support System* (DSS) – CP Berbasis Advenced OPF HCT: Simulator Perancangan Operasi dan Optimasi Jaringan Sistem Distribusi Radial", Disertasi Teknik Elektro TS, Surabaya

i & B. Vahidi, 2012, "*Reconfiguration of Distribution Network to Mitigate Utilities Power Quality Disturbances*", Elsevier, Electrical Power System Research 91, pp. 9-17

T. Gonen, *Electric Power Distribution Engineering*. CRC Press, 2015

Z.O. Prabandaru, O. Penangsang & R.S. Wibowo, 2015, "Optimasi Penentuan Lokasi Kapasitor dan Rekonfigurasi untuk Meminimalkan Kerugian Daya Pada Jaringan Distribusi Radial Menggunakan *Genetic Algorithm*", Tesis Teknik Elektro ITS, Surabaya

LAMPIRAN I

FORWARD BACKWARD SWEEP METHOD AND HARMONIC LOAD FLOW

```
%_____________________________________________________________________%
%  Load flow dan Harmonic Load Flow menggunakan Backward/Forward Sweep  %
%                                                                     %
%  Developed in MATLAB R2018a                                         %
%   Main paper: Teng, J. and Chang, C                                 %
%               Backward/Forward sweep-based harmonic analysis method %
%               for distribution systems                              %
%               ieeexplore.ieee.org/document/4265731/                 %
%                                                                     %
%               Teng, J. H.                                           %
%               Network-topology-based three-phase load flow for      %
%               distribution systems                                  %
%_____________________________________________________________________%
clc
clear all

V_base=20e3;                                % Input V base
S_base=100e6;                                % Input S base

    %linedata adalah data saluran
    RDS
            %dari bus %Ke bus
    linedata = [
      1    2    0.003249125 0.001258875
      2    3    0.1265625   0.2191725
      3    4    0.01125     0.019482
      3    5    0.0084375   0.0146115
      5    6    0.0219      0.019482
      5    7    0.060225    0.0535755
      7    8    0.0219      0.019482
      8    9    0.060225    0.0535755
      9    10   0.005475    0.0048705
      10   11   0.005475    0.0048705
      11   12   0.005475    0.0048705
      12   13   0.0028125   0.0048705
      13   14   0.01095     0.009741
      13   15   0.0196875   0.0340935
      15   16   0.01095     0.009741
      15   17   0.01095     0.009741
      17   18   0.0438      0.038964
      18   19   0.0219      0.019482
      18   20   0.005475    0.0048705
      20   21   0.0219      0.019482
      21   22   0.027375    0.0243525
      22   23   0.005475    0.0048705
      22   24   0.01095     0.009741
      24   25   0.01095     0.009741
      21   26   0.027375    0.0243525
      26   27   0.03285     0.029223
      27   28   0.005475    0.0048705
      28   29   0.060225    0.0535755
      29   30   0.0219      0.019482
      27   31   0.0219      0.019482
           0.005475    0.0048705
           0.027375    0.0243525
           0.03285     0.029223
           0.03285    0.029223
      35   36   0.05475     0.048705
      36   37   0.01095     0.009741
      36   38   0.005475    0.0048705
      38   39   0.01095     0.009741
      12   40   0.03375     0.058446
      40   41   0.028125    0.048705
      41   42   0.005475    0.0048705
      42   43   0.01095     0.009741
      43   44   0.038325    0.0340935
      41   45   0.0219      0.019482
      45   46   0.005475    0.0048705
      45   47   0.016425    0.0146115
      47   48   0.005475    0.0048705
      47   49   0.049275    0.0438345
      49   50   0.01095     0.009741
      50   51   0.03285     0.029223
      50   52   0.01095     0.009741
      52   53   0.005475    0.0048705
      52   54   0.01095     0.009741
      54   55   0.027375    0.0243525
      55   56   0.01095     0.009741
      55   57   0.01095     0.009741
      55   58   0.027375    0.0243525
      58   59   0.060225    0.0535755
      58   60   0.005475    0.0048705
      60   61   0.01095     0.009741
      60   62   0.005475    0.0048705
      62   63   0.005475    0.0048705
      63   64   0.049275    0.0438345
      64   65   0.016425    0.0146115
      64   66   0.01095     0.009741
      66   67   0.005475    0.0048705
      66   68   0.016425    0.0146115
      65   69   0.016425    0.0146115
      64   70   0.0219      0.019482
      70   71   0.016425    0.0146115
      71   72   0.016425    0.0146115
      72   73   0.0219      0.019482
```

```
70  74  0.0219       0.019482
74  75  0.016425     0.0146115
75  76  0.016425     0.0146115
62  77  0.01095      0.009741
77  78  0.005475     0.0048705
77  79  0.01095      0.009741
79  80  0.0876       0.077928
80  81  0.01095      0.009741
81  82  0.038325     0.0340935
82  83  0.07665      0.068187
83  84  0.1095       0.09741
84  85  0.147825     0.1315035
85  86  0.07665      0.068187
86  87  0.005475     0.0048705
87  88  0.071175     0.0633165
84  89  0.01095      0.009741
89  90  0.01095      0.009741
90  91  0.0219       0.019482
91  92  0.01095      0.009741
92  93  0.049275     0.0438345
91  94  0.027375     0.0243525
94  96  0.01095      0.009741
94  95  0.0219       0.019482
90  97  0.049275     0.0438345
97  98  0.01095      0.009741
97  99  0.049275     0.0438345
99  100 0.136875     0.1217625
100 101 0.005475     0.0048705
101 102 0.049275     0.0438345
100 103 0.016425     0.0146115
103 104 0.060225     0.0535755
104 105 0.01095      0.009741
104 106 0.01095      0.009741
106 107 0.0876       0.077928
107 108 0.0219       0.019482
103 109 0.084375     0.146115
109 110 0.005475     0.0048705
110 111 0.016425     0.0146115
111 112 0.016425     0.0146115
112 113 0.049275     0.0438345
113 114 0.01095      0.009741
114 115 0.049275     0.0438345
114 116 0.027375     0.0243525
116 117 0.0219       0.019482
117 118 0.03285      0.029223
118 119 0.005475     0.0048705
118 120 0.01095      0.009741
111 121 0.0219       0.019482
121122 0.001949475 0.000755325
121 123 0.14235      0.126633
123 124 0.0219       0.019482
124 126 0.005475     0.0048705
124 125 0.03285      0.029223
123 127 0.01095      0.009741
127 128 0.005475     0.0048705
127 129 0.005475     0.0048705
129 130 0.093075     0.0827985
130 131 0.0876       0.077928
131 132 0.03285      0.029223
    33  0.005475     0.0048705
    34  0.005475     0.0048705
    35  0.005475     0.0048705
    36  0.027375     0.0243525
    37  0.0438       0.038964
    38  0.027375     0.0243525
138 139 0.01095      0.009741
139 140 0.04011315   0.0679077426
140 141 0.0153531    0.0259913361
141 142 0.0065562    0.0110990222
141 143 0.07823865   0.1324505832
143 144 0.007921725  0.0134107259
143 145 0.013698825  0.0231908060
145 146 0.01095      0.00945475
145 147 0.005220075  0.0088370898
147 148 0.0438       0.037819
147 149 0.007092225  0.0120064614
149 150 0.00414855   0.0070231000
150 151 0.0038871    0.0065804901
149 152 0.0111216    0.0188278096
152 153 0.01254375   0.0210840925
153 154 0.027375     0.0236375
153 155 0.0129003    0.0218389793
155 156 0.027375     0.0236375
155 157 0.049875     0.084433625
157 158 0.002625     0.004443875
158 159 0.002625     0.004443875
159 160 0.002625     0.004443875
160 161 0.03675      0.06221425
161 162 0.018375     0.031107125
162 163 0.007875     0.013331625
163 164 0.013125     0.022219375
164 165 0.00396875   0.002369 ];
```

```
%loaddata adalah data beban
RDS
loaddata= 1e3 *[  2 0       0
                  3 0       0
                  4   85      52.68
                  5   0       0
                  6   170     105.4
                  7   0       0
                  8   85      52.68
                  9   0       0
                  10  85      52.68
                  11  136     84.29
                  12  0       0
                  13  0       0
                  14  85      52.68
                  15  0       0
                  16  170     105.4
                  17  85      52.68
                  18  0       0
                  19  136     84.29
                  20  136     84.29
                  21  85      52.68
                  22  0       0
                  23  42.5    26.34
                  24  136     84.29
                  25  136     84.29
                  26  136     84.29
                  27  0       0
                  28  170     105.4
                  29  85      52.68
                  30  85      52.68
                  31  85      52.68
                  32  0       0
                  33  42.5    26.34
                  34  21.25   13.17
                  35  136     84.29
```

```
     36  0        0
37   212.5    131.7
38   0        0
39   85       52.68
40   170      105.4
41   0        0
42   170      105.4
43   85       52.68
44   170      105.4
45   0        0
46   212.5    131.7
47   0        0
48   85       52.68
49   136      84.29
50   0        0
51   85       52.68
52   0        0
53   85       52.68
54   212.5    131.7
55   0        0
56   85       52.68
57   85       52.68
58   136      84.29
59   136      84.29
60   0        0
61   85       52.68
62   0        0
63   85       52.68
64   0        0
65   170      105.4
66   0        0
67   85       52.68
68   85       52.68
69   85       52.68
70   0        0
71   136      84.29
72   136      84.29
73   85       52.68
74   85       52.68
75   85       52.68
76   85       52.68
77   0        0
78   85       52.68
79   85       52.68
80   136      84.29
81   0        0
82   85       52.68
83   136      84.29
84   0        0
85   136      84.29
86   85       52.68
87   0        0
88   85       52.68
89   136      84.29
90   0        0
91   0        0
92   85       52.68
93   136      84.29
94   0        0
95   170      105.4
96   136      84.29
97   0        0
98   85       52.68
99   85       52.68
100  0        0
101  170      105.4
102  85       52.68
103  0        0
104  42.5     26.34
105  42.5     26.34
106  42.5     26.34
107  42.5     26.34
108  42.5     26.34
109  42.5     26.34
110  42.5     26.34
111  0        0
112  170      105.4
113  85       52.68
114  0        0
115  85       52.68
116  212.5    131.7
117  85       52.68
118  0        0
119  136      84.29
120  85       52.68
121  0        0
122  293.3    181.7
123  85       52.68
124  0        0
125  136      84.29
126  85       52.68
127  85       52.68
128  0        0
129  136      84.29
130  0        0
131  136      84.29
132  85       52.68
133  85       52.68
134  0        0
135  0        0
136  85       52.68
137  85       52.68
138  0        0
139  0        0
140  170      105.4
141  0        0
142  85       52.68
143  0        0
144  85       52.68
145  0        0
146  85       52.68
147  0        0
148  85       52.68
149  0        0
150  85       52.68
151  136      84.29
152  85       52.68
153  0        0
154  85       52.68
155  0        0
156  85       52.68
157  42.5     26.34
158  0        0
159  0        0
160  42.5     26.34
161  85       52.68
162  0        0
163  85       52.68
164  0        0
165  1062.5   658.5 ];
```

```
loadawal = loaddata;

%hsource adalah data injeksi
arus harmonik dimana kolom
pertama adalah bus
%yang di injek oleh arus
harmonisa, kolom ke 2 adalah
magnitud dan kolom ke 3 adalah
sudut

%harmonik orde ke 5
hsource(:,:,1) = [ 2 0       0
                   3  98      140
                   4  0       0
                   5  98      140
                   6  0       0
                   7  0       0
                   8  0       0
                   9  98      140
                  10  98      140
                  11  0       0
                  12  98      0
                  13  98      140
                  14  0       0
                  15  98      140
                  16  0       0
                  17  98      140
                  18  0       0
                  19  98      140
                  20  0       0
                  21  98      140
                  22  0       0
                  23  98      140
                  24  0       0
                  25  98      140
                  26  0       0
                  27  098     140
                  28  0       0
                  29  98      140
                  30  0       0
                  31  98      0
                  32  0       0
                  33  98      140
                  34  0       0
                  35  98      140
                  36  0       0
                  37  98      140
                  38  0       0
                  39  0       0
                  40  98      140
                  41  0       0
                  42  98      140
                  43  0       0
                  44  98      0
                  45  0       0
                  46  98      140
                  47  0       0
                  48  0       0
                  49  98      140
                  50  0       0
                  51  98      0
                  52  0       0
                  53  98      140
                  54  0       0
                  55  98      140
                  56  0       0
                  57  0       0
                  58  98      140
                  59  0       0
                  60  98      140
                  61  0       0
                  62  98      140
                  63  0       0
                  64  98      140
                  65  0       0
                  66  0       0
                  67  98      140
                  68  0       0
                  69  98      0
                  70  0       0
                  71  98      140
                  72  0       0
                  73  98      140
                  74  0       0
                  75  0       0
                  76  98      140
                  77  0       0
                  78  98      140
                  79  0       0
                  80  98      140
                  81  0       0
                  82  98      140
                  83  0       0
                  84  0       0
                  85  98      140
                  86  0       0
                  87  98      0
                  88  0       0
                  89  98      140
                  90  0       0
                  91  98      140
                  92  0       0
                  93  0       0
                  94  98      140
                  95  0       0
                  96  98      140
                  97  0       0
                  98  98      140
                  99  0       0
                 100  98      140
                 101  0       0
                 102  0       0
                 103  98      140
                 104  0       0
                 105  98      140
                 106  0       0
                 107  98      0
                 108  0       0
                 109  98      140
                 110  0       0
                 111  0       0
                 112  98      140
                 113  0       0
                 114  98      140
                 115  0       0
                 116  98      140
                 117  0       0
                 118  98      140
```

```
119 0   0
120 0   0
121 98  140
122 0   0
123 98  140
124 0   0
125 98  0
126 0   0
127 98  140
128 0   0
129 0   0
130 98  140
131 0   0
132 98  140
133 0   0
134 98  140
135 0   0
136 98  140
137 0   0
138 0   0
139 98  140
140 0   0
141 98  140
142 0   0
143 98  140
144 0   0
145 98  0
146 0   0
147 0   0
148 98  140
149 0   0
150 98  140
151 0   0
152 98  140
153 0   0
154 98  140
155 0   0
156 0   0
157 98  140
158 0   0
159 98  140
160 0   0
161 98  0
162 0   0
163 98  140
164 0   0
165 0   0  ];

%harmonik orde ke 7
hsource(:,:,2) = [ 2  0       0
                   3  39.86   113
                   4  0       0
                   5  39.86   113
                   6  0       0
                   7  0       0
                   8  0       0
                   9  39.86   113
                  10  39.86   113
                  11  0       0
                  12  39.86   0
                  13  39.86   113
                  14  0       0
                  15  39.86   113
                  16  0       0
                  17  39.86   113
                  18  0       0
                  19  39.86   113
                  20  0       0
                  21  39.86   113
                  22  0       0
                  23  39.86   113
                  24  0       0
                  25  39.86   113
                  26  0       0
                  27  39.86   113
                  28  0       0
                  29  39.86   113
                  30  0   0
                  31  39.86   0
                  32  0   0
                  33  39.86   113
                  34  0   0
                  35  39.86   113
                  36  0   0
                  37  39.86   113
                  38  0   0
                  39  39.86   113
                  40  0   0
                  41  39.86   113
                  42  0   0
                  43  39.86   113
                  44  0   0
                  45  39.86   113
                  46  0   0
                  47  39.86   113
                  48  0   0
                  49  39.86   113
                  50  0   0
                  51  39.86   0
                  52  0   0
                  53  39.86   113
                  54  0   0
                  55  39.86   113
                  56  0   0
                  57  39.86   113
                  58  0   0
                  59  39.86   113
                  60  0   0
                  61  39.86   113
                  62  0   0
                  63  39.86   113
                  64  0   0
                  65  39.86   113
                  66  0   0
                  67  39.86   113
                  68  0   0
                  69  39.86   0
                  70  0   0
                  71  39.86   113
                  72  0   0
                  73  39.86   113
                  74  0   0
                  75  39.86   113
                  76  0   0
                  77  39.86   113
                  78  0   0
                  79  39.86   113
                  80  0   0
                  81  39.86   113
                  82  0   0
```

```
83  39.86   113
84  0   0
85  39.86   113
86  0   0
87  39.86   0
88  0   0
89  39.86   113
90  0   0
91  39.86   113
92  0   0
93  39.86   113
94  0   0
95  39.86   113
96  0   0
97  39.86   113
98  0   0
99  39.86   113
100 0   0
101 39.86   113
102 0   0
103 39.86   113
104 0   0
105 39.86   113
106 0   0
107 39.86   0
108 0   0
109 39.86   113
110 0   0
111 39.86   113
112 0   0
113 39.86   113
114 0   0
115 39.86   113
116 0   0
117 39.86   113
118 0   0
119 39.86   113
120 0   0
121 39.86   113
122 0   0
123 39.86   113
124 0   0
125 39.86   0
126 0   0
127 39.86   113
128 0   0
129 39.86   113
130 0   0
131 39.86   113
132 0   0
133 39.86   113
134 0   0
135 39.86   113
136 0   0
137 39.86   113
138 0   0
139 39.86   113
140 0   0
141 39.86   113
142 0   0
143 39.86   113
144 0   0
145 39.86   0
146 0   0
147 39.86   113
148 0   0
149 39.86   113
150 0   0
151 39.86   113
152 0   0
153 39.86   113
154 0   0
155 39.86   113
156 0   0
157 39.86   113
158 0   0
159 39.86   113
160 0   0
161 39.86   0
162 0   0
163 39.86   113
164 0   0
165 39.86   113 ];

%harmonik orde ke 11
hsource(:,:,3) = [2 18.95   -158
                  3   0   0
                  4   0   0
                  5  18.95   -158
                  6   0   0
                  7   0   0
                  8   0   0
                  9   0   0
                  10  0   0
                  11  0   0
                 12  18.95   -158
                 13  0   0
                 14  0   0
                 15  18.95   -158
                 16  0   0
                 17  18.95   -158
                 18  18.95   -158
                 19  18.95   -158
                 20  0   0
                 21  0   0
                 22  0   0
                 23  0   0
                 24  0   0
                 25  0   0
                 26  18.95   -158
                 27  18.95   -158
                 28  0   0
                 29  0   0
                 30  0   0
                 31  18.95   -158
                 32  18.95   -158
                 33  0   0
                 34  0   0
                 35  0   0
                 36  0   0
                 37  18.95   -158
                 38  0   0
                 39  0   0
                 40  0   0
                 41  0   0
                 42  18.95   -158
                 43  0   0
                 44  18.95   -158
                 45  0   0
                 46  0   0
```

```
47  0    0
48  0    0
49  0    0
50  0    0
51  18.95   -158
52  0    0
53  18.95   -158
54  18.95   -158
55  0    0
56  0    0
57  18.95   -158
58  0    0
59  0    0
60  18.95   -158
61  18.95   -158
62  18.95   -158
63  0    0
64  0    0
65  18.95   -158
66  0    0
67  0    0
68  18.95   -158
69  18.95   -158
70  0    0
71  0    0
72  18.95   -158
73  0    0
74  0    0
75  0    0
76  0    0
77  0    0
78  0    0
79  18.95   -158
80  0    0
81  0    0
82  18.95   -158
83  0    0
84  0    0
85  18.95   -158
86  18.95   -158
87  18.95   -158
88  0    0
89  18.95   -158
90  0    0
91  18.95   -158
92  0    0
93  18.95   -158
94  0    0
95  18.95   -158
96  0    0
97  18.95   -158
98  0    0
99  18.95   -158
100 0    0
101 18.95   -158
102 0    0
103 18.95   -158
104 0    0
105 18.95   -158
106 0    0
107 18.95   -158
108 0    0
109 18.95   -158
110 0    0
111 18.95   -158
112 0    0
113 18.95   -158
114 0    0
115 18.95   -158
116 0    0
117 18.95   -158
118 0    0
119 18.95   -158
120 0    0
121 18.95   -158
122 0    0
123 18.95   -158
124 0    0
125 18.95   -158
126 0    0
127 18.95   -158
128 0    0
129 18.95   -158
130 0    0
131 18.95   -158
132 0    0
133 18.95   -158
134 0    0
135 18.95   -158
136 0    0
137 18.95   -158
138 0    0
139 18.95   -158
140 0    0
141 18.95   -158
142 0    0
143 18.95   -158
144 0    0
145 18.95   -158
146 0    0
147 18.95   -158
148 0    0
149 18.95   -158
150 0    0
151 18.95   -158
152 0    0
153 18.95   -158
154 0    0
155 18.95   -158
156 0    0
157 18.95   -158
158 0    0
159 18.95   -158
160 0    0
161 18.95   -158
162 0    0
163 18.95   -158
164 0    0
165 18.95   -158 ];

%harmonik orde ke 13
hsource(:,:,4) = [  2   0       0
                    3   8.79    -178
                    4   0       0
                    5   8.79    -178
                    6   0       0
                    7   0       0
                    8   0       0
                    9   8.79    -178
                   10   8.79    -178
```

11	0	0
12	8.79	0
13	8.79	-178
14	0	0
15	8.79	-178
16	0	0
17	8.79	-178
18	0	0
19	8.79	-178
20	0	0
21	8.79	-178
22	0	0
23	8.79	-178
24	0	0
25	8.79	-178
26	0	0
27	8.79	-178
28	0	0
29	8.79	-178
30	0	0
31	8.79	0
32	0	0
33	8.79	-178
34	0	0
35	8.79	-178
36	0	0
37	8.79	-178
38	0	0
39	8.79	-178
40	0	0
41	8.79	-178
42	0	0
43	8.79	-178
44	0	0
45	8.79	-178
46	0	0
47	8.79	-178
48	0	0
49	8.79	-178
50	0	0
51	8.79	0
52	0	0
53	8.79	-178
54	0	0
55	8.79	-178
56	0	0
57	8.79	-178
58	0	0
59	8.79	-178
60	0	0
61	8.79	-178
62	0	0
63	8.79	-178
64	0	0
65	8.79	-178
66	0	0
67	8.79	-178
68	0	0
69	8.79	0
70	0	0
71	8.79	-178
72	0	0
73	8.79	-178
74	0	0
75	8.79	-178
76	0	0
77	8.79	-178
78	0	0
79	8.79	-178
80	0	0
81	8.79	-178
82	0	0
83	8.79	-178
84	0	0
85	8.79	-178
86	0	0
87	8.79	0
88	0	0
89	8.79	-178
90	0	0
91	8.79	-178
92	0	0
93	8.79	-178
94	0	0
95	8.79	-178
96	0	0
97	8.79	-178
98	0	0
99	8.79	-178
100	0	0
101	8.79	-178
102	0	0
103	8.79	-178
104	0	0
105	8.79	-178
106	0	0
107	8.79	0
108	0	0
109	8.79	-178
110	0	0
111	8.79	-178
112	0	0
113	8.79	-178
114	0	0
115	8.79	-178
116	0	0
117	8.79	-178
118	0	0
119	8.79	-178
120	0	0
121	8.79	-178
122	0	0
123	8.79	-178
124	0	0
125	8.79	0
126	0	0
127	8.79	-178
128	0	0
129	8.79	-178
130	0	0
131	8.79	-178
132	0	0
133	8.79	-178
134	0	0
135	8.79	-178
136	0	0
137	8.79	-178
138	0	0
139	8.79	-178
140	0	0

```
141 8.79    -178
142 0     0
143 8.79    -178
144 0     0
145 8.79    0
146 0     0
147 8.79    -178
148 0     0
149 8.79    -178
150 0     0
151 8.79    -178
152 0     0
153 8.79    -178
154 0     0
155 8.79    -178
156 0       0
157 8.79    -178
158 0       0
159 8.79    -178
160 0       0
161 8.79    0
162 0       0
163 8.79    -178
164 0       0
165 8.79 -178 ];

%harmonik orde ke 17
hsource(:,:,5) = [ 2   0       0
                   3   2.5    -94
                   4   0       0
                   5   2.5    -94
                   6   0       0
                   7   0       0
                   8   0       0
                   9   2.5    -94
                  10   2.5    -94
                  11   0       0
                  12   2.5     0
                  13   2.5    -94
                  14   0       0
                  15   2.5    -94
                  16   0       0
                  17   2.5    -94
                  18   0       0
                  19   2.5    -94
                  20   0       0
                  21   2.5    -94
                  22   0       0
                  23   2.5    -94
                  24   0       0
                  25   2.5    -94
                  26   0       0
                  27   2.5    -94
                  28   0       0
                  29   2.5    -94
                  30   0      0
                  31   2.5    0
                  32   0      0
                  33   2.5    -94
                  34   0      0
                  35   2.5    -94
                  36   0      0
                  37   2.5    -94
                  38   0      0
                  39   2.5    -94
                  40   0      0
                  41   2.5    -94
                  42   0      0
                  43   2.5    -94
                  44   0      0
                  45   2.5    -94
                  46   0      0
                  47   2.5    -94
                  48   0      0
                  49   2.5    -94
                  50   0      0
                  51   2.5    0
                  52   0      0
                  53   2.5    -94
                  54   0      0
                  55   2.5    -94
                  56   0      0
                  57   2.5    -94
                  58   0      0
                  59   2.5    -94
                  60   0      0
                  61   2.5    -94
                  62   0      0
                  63   2.5 -94
                  64   0   0
                  65   2.5 -94
                  66   0   0
                  67   2.5 -94
                  68   0   0
                  69   2.5 0
                  70   0   0
                  71   2.5 -94
                  72   0   0
                  73   2.5 -94
                  74   0   0
                  75   2.5 -94
                  76   0   0
                  77   2.5 -94
                  78   0   0
                  79   2.5 -94
                  80   0   0
                  81   2.5 -94
                  82   0   0
                  83   2.5 -94
                  84   0   0
                  85   2.5 -94
                  86   0   0
                  87   2.5 0
                  88   0   0
                  89   2.5 -94
                  90   0   0
                  91   2.5 -94
                  92   0   0
                  93   2.5 -94
                  94   0   0
                  95   2.5 -94
                  96   0   0
                  97   2.5 -94
                  98   0   0
                  99   2.5 -94
                  100  0   0
                  101  2.5 -94
                  102  0   0
                  103  2.5 -94
                  104  0   0
```

```
105 2.5 -94                    136 0   0
106 0   0                      137 2.5 -94
107 2.5 0                      138 0   0
108 0   0                      139 2.5 -94
109 2.5 -94                    140 0   0
110 0   0                      141 2.5 -94
111 2.5 -94                    142 0   0
112 0   0                      143 2.5 -94
113 2.5 -94                    144 0   0
114 0   0                      145 2.5 0
115 2.5 -94                    146 0   0
116 0   0                      147 2.5 -94
117 2.5 -94                    148 0   0
118 0   0                      149 2.5 -94
119 2.5 -94                    150 0   0
120 0   0                      151 2.5 -94
121 2.5 -94                    152 0   0
122 0   0                      153 2.5 -94
123 2.5 -94                    154 0   0
124 0   0                      155 2.5 -94
125 2.5 0                      156 0   0
126 0   0                      157 2.5 -94
127 2.5 -94                    158 0   0
128 0   0                      159 2.5 -94
129 2.5 -94                    160 0   0
130 0   0                      161 2.5 0
131 2.5 -94                    162 0   0
132 0   0                      163 2.5 -94
133 2.5 -94                    164 0   0
134 0   0                      165 2.5 -94 ];
135 2.5 -94
```

```
harmonic_exist=[5 7 11 13 17];
aa=size(harmonic_exist);
harmonic_orde=aa(1,2);
busdata= sortrows(linedata,2);
linedata=sortrows(linedata,2);
nbus=max(busdata(:,2));
nbranch=nbus-1;
I_base = S_base / (V_base * 1.73);
Z_base=(V_base^2)/S_base;

% Main BACKWARD/FORWARD SWEEP Load Flow
Vawal(1:nbranch,1)=1;
K=zeros(nbranch,nbus);
line=zeros(nbranch,nbranch);
for ii=1:nbranch
    K(:,busdata(ii,2))= K(:,busdata(ii,1));
    K(ii,busdata(ii,2))=-1;
    line(busdata(ii,1),busdata(ii,2))=1;
    if nofilter ~= 0
        loaddata(ii,3) = loaddata(ii,3) - filterdata(ii,3);
   %jika ada filter maka loaddata pada bus yang terdapat filter
berubah (Lihat Paper)
    end

    line;

    :end);
    ne(:,2:end);
    ne=size(line);
```

```
Sawal=zeros(nbranch,1);
for ii=1:nbranch
    Sawal(ii,1)=((loaddata(ii,2)+loaddata(ii,3)*j))./S_base;
end
clear ii
Sawal;

FBM1=[((linedata(:,3)+linedata(:,4)*i))./Z_base];
FBM=zeros(nbranch,nbranch);
for ii=1:nbranch
    FBM(:,ii)=FBM1(ii,1);
end
FBM;

% membangung matriks yang dibutuhkan
BIBC=-K;
BCBV=BIBC'.*FBM;
DLF=BCBV*BIBC;

max_error=0.0000001;
error=1;
iterasi=100;
Ix(:,:,iterasi) = conj(Sawal./Vawal);
deltaV = DLF * Ix(:,:,iterasi);
VbusNEW = (Vawal - deltaV);

while error > max_error
    iterasi=iterasi+1;
    Ix(:,:,iterasi) = conj(Sawal./VbusNEW);
    Ib=BIBC*Ix(:,:,iterasi);
    deltaV = DLF * Ix(:,:,iterasi);     %menghitung selisih tegangan
    VbusNEW = (Vawal - deltaV);      %menghitung besar tegangan bus
    error=max(abs(Ix(:,:,iterasi)-Ix(:,:,iterasi-1)));%iterasi
akan berhenti jika error < max_error
end
VbusNEW;
magnitudV=abs(VbusNEW);
sudutV=angle(VbusNEW)*(180/pi);
tegbusNEW= [abs(VbusNEW) ((angle(VbusNEW))*180/pi)];
Ifund = Ix(:,:,iterasi);
magnitudI=abs(Ifund);
sudutA=angle(Ifund)*(180/pi);
Snew = VbusNEW .*Ifund;

Sbranch = VbusNEW .* Ib; %Mencari besar bus loading fundamental (PU)
Ibranch = abs(Ib)*I_base; %Mencari Arus pada tiap branch fundamental
(Ampere)

% Menghitung rugi-rugi daya fundamental total
clear ii
absIb = abs(Ib);
Ibb=zeros(nbranch,1);
    l:nbranch
    (ii,1) = absIb(ii,1) * absIb(ii,1);


=  FBM1'*Ibb;     %Ploss = R transpose x |B|^2 (Lihat Paper)
Fund = Ploss1 * S_base; %Didapatkan Ploss Fundamental
```

```
% Mencari rugi-rugi daya tiap branch
PLIndBus = zeros(nbranch,2);
clear uu
for uu=1:nbranch
    PLIndBus(uu,1) = uu+1;
    PLIndBus(uu,2) = FBM1(uu,1) * Ibb(uu,1);
    PLIndBus(uu,2) = PLIndBus(uu,2)*S_base;
end
PLIndBus;

% Main HARMONIC LOAD FLOW (HLF)
clear ii jj h kk
for ii=1:nbranch
    if Snew(ii)==0
        Zloads(ii,1)=0;
    else

Zloads(ii,1)=((VbusNEW(ii))/(conj(Snew(ii)./VbusNEW(ii))));
    end
end
Zloads;

% Mendapatkan arus injeksi harmonis A+jB
clear ii jj
for ii=1:harmonic_orde
    for jj=1:nbranch

harm_source(jj,1,ii)=(((hsource(jj,2,ii)./100)*cos(hsource(jj,3,ii
)))+((hsource(jj,2,ii)./100)*sin(hsource(jj,3,ii)))*1j);
    end
end
harm_source;


% Mendapatkan Z filter pada frekuensi fundamental
h=1;
if nofilter ~= 0
    Z_filter_1=(filterimpedance(:,2))+(1j*filterimpedance(:,3)*h);
    load_filter1 = Z_filter_1;
end

mutual_1=real(BCBV)+1j*imag(BCBV)*h; %Mendapatkan Mutual untuk
matrik HA pada frekuensi Fundamental
line_h1 = real(FBM1)+1j*imag(FBM1)*h; %Mendapatkan Zij untuk
menghitung Ploss pada frekuensi Fundamental
Zload_1=real(Zloads)+1j*imag(Zloads)*h; %Mendapatkan Zbeban pada
frekuensi fundamental
load_1=Zload_1;


PlossH= 0;
for hh=1:harmonic_orde
    iterasi=1;
        _err=0.01;
        =1;

        ıs_h(:,:,hh)=zeros(nbranch,1);
        ıs_h(:,:,hh)=zeros(nbranch,1);
        ıs_h(:,:,hh)=zeros(nbranch,1);
```

```
% Mencari arus beban awal
Ihh1 = Ib;
Ihh1(Ihh1(:,1) == 0, :) = [];
Ih1 = Ihh1;


while err > max_err
    iterasi=iterasi+1;
    if hh==1
    h=5;
    source_1=(abs(harm_source(:,:,hh)).*(Ifund));
    end
    if hh==2
    h=7;
    source_1=(abs(harm_source(:,:,hh)).*(Ifund));
    end
    if hh==3
    h=11;
    source_1=(abs(harm_source(:,:,hh)).*(Ifund));
    end
    if hh==4
    h=13;
    source_1=(abs(harm_source(:,:,hh)).*(Ifund));
    end
    if hh==5
    h=17;
    source_1=(abs(harm_source(:,:,hh)).*(Ifund));
    end

    mutual=(real(mutual_1)+1j*(imag(mutual_1)*h));
% Mutual akan berubah dengan berubahnya orde harmonisa
    line_h = (real(line_h1)+1j*(imag(line_h1)*h));
% Line (Zij) akan berubah dengan berubahnya orde harmonisa
    Zload=(real(Zload_1)+1j*(imag(Zload_1)*h));
% Zload (Z beban) akan berubah dengan berubahnya orde harmonisa
    load=Zload;

    clear ii
    size_load=size(Zload);
    size_source=size(source_1);

    [totBusHarmonisa,aaa]=size(find(hsource(:,2,1)~=0));
    [totBusLoad,aaa]=size(find(loaddata(:,2)~=0));

    [Zload_num,aaa]=size(find(Zload(:,1)~=0));

    sumber=totBusHarmonisa;
    load_num1=totBusLoad;
    filter_num=totFilter;
    parallel= totBusHarmonisa + totBusLoad +totFilter;
    A1=zeros(nbranch,parallel);
    kk=linedata(:,1:2);
    n=nbranch;

    % Mencari matrik A (Lihat Main Paper)
    for ii=nbranch:-1:1
        for jj=nbranch:-1:1
            if line(ii,jj)~=0
```

```
                if hsource(jj,2,1)~=0
                    A1(jj,sumber)=1;
                    if sumber ~=1
                        sumber=sumber -1;
                    end
                end
                if loaddata(jj,2)~=0
                    A1(jj,totBusHarmonisa+load_num1)=1;
                    if load_num1 ~=1
                        load_num1=(load_num1)-1;
                    end
                end
                if totFilter ~= 0
                    if filterimpedance(jj,2)~=0
               A1(jj,totBusHarmonisa+totBusLoad+filter_num)=1;
                        if totFilter ~=1
                                totFilter=(totFilter)-1;
                        end
                    end
                end
            end
        end
    end
A1;
A5 = A1;

clear ii jj
for ii=nbranch:-1:2
    for jj=nbranch:-1:1
        if line(ii,jj)~=0
            for k=1:nbranch
                if line(k,ii-1)~=0
                    for m=1:parallel
                        if A1(jj,m)~=0
                            A1(ii-1,m)=A1(jj,m);
                        end
                    end
                end
            end
        end
    end
end
A1;


AA = A1;
A = A1;

% Mencari Elemen Parallel Iharmonik
Ih=zeros(totBusHarmonisa,1);
clear ip
ip=1;

for n=1:size_source(1,1)
    if source_1(n,1)~= 0
        Ih(ip,1)=source_1(n,1);
        ip=ip+1;
    end
end
```

```
IL=zeros(totBusHarmonisa+totBusLoad,1);
size_Ih=size(Ih);

clear il
k=1;
for il=1:totBusHarmonisa+totBusLoad
    if il<= size_Ih(1,1)
        IL(il,1)=Ih(il,1);
    else
        if k<= Zload_num
           IL(il,1)=Ih1(k,1);
           k=k+1;
        end
   end
end

% Mencari matrik HA (Lihat Main Paper)
clear ii jj kk k m
HA=zeros(nbranch,parallel);
for ii=1:parallel
    BA=0;
     for jj=1:nbranch
        if AA(jj,ii)~=0
            B=BA+mutual(:,jj);
            BA=B;
        end
    end
    BA;
    HA(:,ii)=BA;
end
HA;

% Jika ada filter maka dibutuhkan beberapa matrik untuk
mendapatkan
% Is atau arus yang mengalir pada filter
if totFilter ~=0
    % Mencari Matrik HAss
    HAss=zeros(totFilter);
    ihass=1;
    jhass=1;
    for n=1:size_load_filter(1,1)
        if filterimpedance(n,2)~= 0
            while jhass<=Zfilter_num
                HAss(ihass,jhass)=HA(n,parallel);
                jhass=jhass+1;
            end
            ihass=ihass+1;
            jhass=1;
        end
    end

    % Mencari Matrik HAsh
    HAsh=zeros(totFilter,totBusLoad+totBusHarmonisa);
    ihash=1;
    jhash=1;

    end
```

```
        end

        % Menghitung Arus cabang
        BI = AA * I;
        delV(:,:,iterasi) = mutual*AA*I;


        V_bus_h(:,:,iterasi)=HA*I; %V harmonik pada iterasi(Lihat
Main Paper)
        V_h(:,:,iterasi)=V_bus_h(:,:,iterasi);
        V(:,:,hh)=abs(V_bus_h(:,:,iterasi));
        Vthd(:,:,hh) = V_bus_h(:,:,iterasi);
        sudutVthd(:,:,hh)=angle(Vthd(:,:,hh))*(180/pi);


        err=max(abs(V_bus_h(:,:,iterasi)-(V_bus_h(:,:,iterasi-
1))));    % Iterasi akan berhenti jika error < max_err


        Ihh = zeros(nbranch,1);
        clear pp
        for pp=1:nbranch
            if load_1(pp,1)==0
                Ihh(pp,1)=0;
                I_bus_h(pp,:,iterasi) = 0;
            else
                Ihh(pp,1) = (V_bus_h(pp,:,iterasi))./load(pp,1);
                I_bus_h(pp,:,iterasi) =
(V_bus_h(pp,:,iterasi))./load(pp,1);
            end
        end
        Ih1 = Ihh;
        Ih1(Ih1(:,1) == 0, :) = [];  % Ih adalah arus beban pada
harmonisa ke h

        % not sure :p
        Iabs(:,:,hh) = abs(I_bus_h(:,:,iterasi));
        Ithd(:,:,hh) = I_bus_h(:,:,iterasi);
        sudutIthd(:,:,hh)=angle(Ithd(:,:,hh))*(180/pi);
    end

    clear ii
    absbi = abs(BI);
    Ibbi=zeros(nbranch,1);
    for ii=1:nbranch
        Ibbi(ii,1) = absbi(ii,1) * absbi(ii,1);
    end
    Ibbi;
    Plossh =  line_h'*Ibbi;         % Ploss = R transpose x |B|^2
    Plhar(hh,1) = Plossh * S_base;  % Plhar = Loss pada tiap orde
harmonisa

    PlossH = PlossH + Plhar(hh,1);

        anch_h(:,:,hh) = V(:,:,hh) .* BI;
        anch_h(:,:,hh) = abs(BI)*I_base ;

        casi;
        or;
```

```
end


PlosskWFund;
PlossH;

PlossTotal = PlosskWFund + PlossH;


%Menghitung Ploss dan Q loss Total
PLFund = PlosskWFund;
PLHar = PlossH;
PLTotal = PlossTotal;
PLTotalP = abs(real(PLFund))+ abs(real(PLHar));
PLTotalQ = abs(imag(PLFund))+ abs(imag(PLHar));
PLTotal = PLTotalP + 1j*(PLTotalQ);
PLHind = real(Plhar)/1e3;
QLHind = imag(Plhar)/1e3;

Vtot1=zeros(nbranch,1);
Vtot2=zeros(nbranch,1);

Itot1=zeros(nbranch,1);
Itot2=zeros(nbranch,1);

for ii=1:nbranch
    addd=zeros(nbranch,1);
    adddd=zeros(nbranch,1);
    for hk=1:harmonic_orde
        Vtot1(ii,1)=addd(ii,1)+(V(ii,:,hk)^2);
        Itot1(ii,1)=adddd(ii,1)+(Iabs(ii,:,hk)^2);
        addd=Vtot1;
        adddd=Itot1;
    end
    Vtot2(ii,1)=sqrt(Vtot1(ii,1));
    Itot2(ii,1)=sqrt(Itot1(ii,1));
end
Vtot1;
Vtot2;
Itot1;
Itot2;

% Menghitung THDv dan THDi
THD=zeros(nbranch,1);
THDi=zeros(nbranch,1);
Vrms=zeros(nbranch,1);
Irms=zeros(nbranch,1);
THDave = 0;
for ii=1:nbranch
    THD(ii,1)=(Vtot2(ii,1)./magnitudV(ii,1));
    THDi(ii,1)=(Itot2(ii,1)./magnitudI(ii,1));
    Vrms(ii,1)=sqrt((magnitudV(ii,1))^2+ Vtot1(ii,1));
    Irms(ii,1)=sqrt((magnitudI(ii,1))^2+ Itot1(ii,1));
       ave = (THDave + THD(ii,1));



     = THDave*100/12;
.*100;
```

```
THDi=THDi.*100;


% Print hasil

display(['RDS ', num2str(nbranch+1),' Bus, dengan V base
:',num2str(V_base), ' V, dan S base : ',num2str(S_base), ' VA']);
if Q_filter ~=0
    display(['Single-tuned filter ke-',
num2str(frekuensi_tuning),' dengan Qc :',num2str(Q_filter/1e3), '
KVAR, dipasang pada bus ',num2str(bus_ke)]);
    fprintf('\n\n');
end

clear ii jj
head
=['_____________________________________________________________________'
                HLF BESAR ARUS YANG MENGALIR PADA CABANG (AMPERE)
'

'_____________________________________________________________________'
'    Branch    Ibranch_Fund        Ibranch_5th        Ibranch_7th     Ibranch_11th
Ibranch_13th        Ibranch_17th'

'_____________________________________________________________________'];
disp(head)
for ii=1:nbranch
     fprintf(' \n%5.0f - %2.0f', [linedata(ii,1),
linedata(ii,2)]),
     fprintf('%15.4f', Ibranch(ii,1)),
     for jj=1:harmonic_orde
         fprintf('%19.4f', Ibranch_h(ii,1,jj))
     end
end
fprintf('\n\n');


clear ii jj
head
=['_____________________________________________________________________'
      '                  HLF TOTAL BUS LOADING (KVA)
'

'_____________________________________________________________________'
'    Bus       S_fund        S_5th        S_7th       S_11th      S_13th    S_17th
'

'_____________________________________________________________________'];
disp(head)
for ii=1:nbranch
     fprintf(' \n%6.3g', ii+1),
     fprintf('%15.2f', (abs(Sbranch(ii,1))*S_base)/1e3),
     for jj=1:harmonic_orde
         fprintf('%12.2f', (abs(Sbranch_h(ii,1,jj))*S_base)/1e3)
     end
end
fprintf('\n\n');
```

```
head
=['_____________________________________________________________________________'
      '                          HARMONIC LOAD FLOW THD V
'

'_____________________________________________________________________________'
'    Bus    V_fund | sudut        V_H_5 | sudut       V_H_7 | sudut       V_H_11 |
sudut      V_H_13 | sudut      V_H_17 | sudut     Vrms       THDv(%)'

'_____________________________________________________________________________'];
disp(head)
for ii=1:nbranch
    if ii==1
        fprintf(' \n%6.3g', ii+1),
        fprintf(' %12.4f %7.3f', [Vawal(ii,:), 0]),
        for kk=1:harmonic_orde
            fprintf('%12.4f %7.3f', [0, 0])
        end
        fprintf(' %10.5f',0),
        fprintf(' %10.5f',0),
    end

     fprintf(' \n%6.3g', ii+1),
     fprintf(' %12.4f %7.3f', [abs(tegbusNEW(ii,1)),
sudutV(ii,1)]),
     for jj=1:harmonic_orde
         fprintf('%12.4f %7.3f', [abs(Vthd(ii,1,jj)),
sudutVthd(ii,1,jj)])
     end
     fprintf(' %10.5f', Vrms(ii,1)),
     fprintf(' %10.5f', THD(ii,1)),


end
fprintf('\n\n');

clear ii jj
head
=['_____________________________________________________________________________'
      '                      HARMONIC LOAD FLOW THD I
'

'_____________________________________________________________________________'
'    Bus    I_fund | sudut        I_H_5 | sudut        I_H_7 | sudut        I_H_11
| sudut       I_H_13 | sudut       I_H_17 | sudut     Irms       THDi(%)'

'_____________________________________________________________________________'];
disp(head)
for ii=1:nbranch
     fprintf(' \n%6.3g', ii+1),
     fprintf('%12.4f %8.3f', [abs(Ifund(ii,1)), sudutA(ii,1)]),
     for jj=1:harmonic_orde
         fprintf('%12.4f %8.3f', [abs(Ithd(ii,1,jj)),
sudutIthd(ii,1,jj)])
     end
     fprintf(' %10.5f', Irms(ii,1)),
     fprintf(' %10.5f', THDi(ii,1)),

   ('\n\n');
   j
```

```
head
=['_____________________________________________________________________________'
       '                      HLF POWER LOSS (KW/KVAR)                              '

'_____________________________________________________________________________'
'    LOSS       Fundamental       5th_Order        7th_Order       11th_Order
13th_Order      17th_Order       Total(KW/KVAR)'

'_____________________________________________________________________________'];
disp(head)
fprintf('    Ploss %12.4f',real(PLFund/1e3)),
for jj=1:harmonic_orde
     fprintf('%16.4f', PLHind(jj,1))
end
fprintf('%20.2f', real(PLTotal/1e3)),
fprintf('\n    Qloss %12.4f',abs(imag(PLFund/1e3))),
for jj=1:harmonic_orde
     fprintf('%16.4f', abs(QLHind(jj,1)))
end
fprintf('%20.2f', imag(PLTotal/1e3)),
fprintf('\n');
```

LAMPIRAN II

PARTICLE SWARM OPTIMIZATION

```
solusi=randi([1,165],10,1);
solusi=posisi(329:end);linedataupt=linedata;HasilAkhir;
loaddata=[[2000:1000:165000]' posisi(1:164) posisi(165:328)]
[p q]= FO(linedata,loaddata)


function posisi=normposisi(posisi,minP,maxP,maxQ,minQ,n_P,n_Q)

    for j=1:size(posisi,2)
        solusi=posisi(329:end,j);
        solusi=round(solusi);
        solusi(find(solusi>165))=165;
        solusi(find(solusi<1))=1;

        p=posisi(1:164,j);
        q=posisi(165:328,j);

        p(find(p>maxP))=maxP;
        p(find(p<minP))=minP;

        q(find(q>maxQ))=maxQ;
        q(find(q<minQ))=minQ;

        %jika terlalu banyak
        matp=find(p>0); nump=length(matp);
        if nump>n_P
           itv=nump-n_P;
           take=randperm(nump,itv);
           p(matp(take))=0;
        end

        %jika terlalu banyak
        matq=find(q>0); numq=length(matq);
        if numq>n_Q
           itv=numq-n_Q;
           take=randperm(numq,itv);
           q(matq(take))=0;
        end

        posisi(1:164,j)=p;
        posisi(165:328,j)=q;
        posisi(329:end,j)=solusi;
    end

end

%deklarasi variabel
```

```
    ; linedata=linedataupt;
    um(handles.minP.String);
    um(handles.maxP.String);
```

```
minQ = str2num(handles.minQ.String);
maxQ = str2num(handles.maxQ.String);
n = str2num(handles.var_n.String);
a = str2num(handles.var_a.String);
b = str2num(handles.var_b.String);
c = str2num(handles.var_c.String);
n_P = str2num(handles.n_P.String);
n_Q = str2num(handles.n_Q.String);
c1 = str2num(handles.var_c1.String);
c2 = str2num(handles.var_c2.String);
nite = str2num(handles.nite.String);

v = zeros(338,n);
posisi = [];
for i = 1:n

    p = randi([minP maxP], 164, 1);
    q = randi([minQ maxQ], 164, 1);
    solusi=randi([1,165],10,1);
    posisi = cat(2,posisi,[p;q;solusi]);

end

posisi=normposisi(posisi,minP,maxP,maxQ,minQ,n_P,n_Q);

%Fitness untuk sejumlah n partikel
Fitness = [];
for j = 1:n

    solusi=posisi(329:end,j);HasilAkhir;
    loaddata=[[2000:1000:165000]' posisi(1:164,j) posisi(165:328,j)];
    fo= get_FO(1,linedata,loaddata,a,b,c)
    Fitness = cat (2,Fitness,fo);
%     input('mengecek')
end

%mencari pBest
[fitBest idx]= min(Fitness);
pBest = posisi(:,idx);

%mencari gBest
gBest = pBest;
gfitBest = fitBest;
% Fitness
% input('cek')

savedata=[0 gfitBest];
handles.text3.String=['Processing...'];pause(1);
for iterasi=1:nite
    disp(iterasi/nite*100)

    %mencari velocity
    v0=v;
                ;
                (:,i) + c1*rand(338,1).*[pBest-
                +c2*rand(338,1).*[gBest-posisi(:,1)];
```

```
    v = [];
    for k = 1:n;
        v = cat(2,v, v0(:,k) + c1*rand(338,1).*[pBest-
posisi(:,k)]+c2*rand(338,1).*[gBest-posisi(:,k)]);
    end

    posisi = posisi + v;
    posisi=normposisi(posisi,minP,maxP,maxQ,minQ,n_P,n_Q);

    %Fitness untuk sejumlah n partikel
    Fitness = [];
    for j = 1:n;

        solusi=posisi(329:end,j);HasilAkhir;
        loaddata=[[2000:1000:165000]' posisi(1:164,j)
posisi(165:328,j)];
        fo= get_FO(0,linedata,loaddata,a,b,c);

        Fitness = cat(2,Fitness,fo);
    end

    %mencari pBest
    [fitBest idx]= min(Fitness);
    pBest = posisi(:,idx);

    if fitBest < gfitBest;
        gfitBest  = fitBest;
        gBest = pBest;

    end
    savedata=cat(1,savedata,[iterasi gfitBest]);
end
plot(handles.axes_grafik,savedata(:,1),savedata(:,2))
xlabel(handles.axes_grafik,'ITERASI')
ylabel(handles.axes_grafik,'Fitness')
clc;
solusi=gBest(329:end);HasilAkhirShow;
loaddata=[[2000:1000:165000]' gBest(1:164) gBest(165:328)];
fo= get_FO(1,linedata,loaddata,a,b,c);

p=gBest(1:164);nump=length(find(p>0));
q=gBest(165:328);numq=length(find(q>0));
%print
disp('PENAMPATAN DG')
save data.mat gBest savedata

display(['Jumlah p: ' num2str(nump)]);
display(['Jumlah q: ' num2str(numq)]);
display(['FO: ' num2str(fo)]);
handles.text3.String=['Done'];
```