REFERENCE LIST

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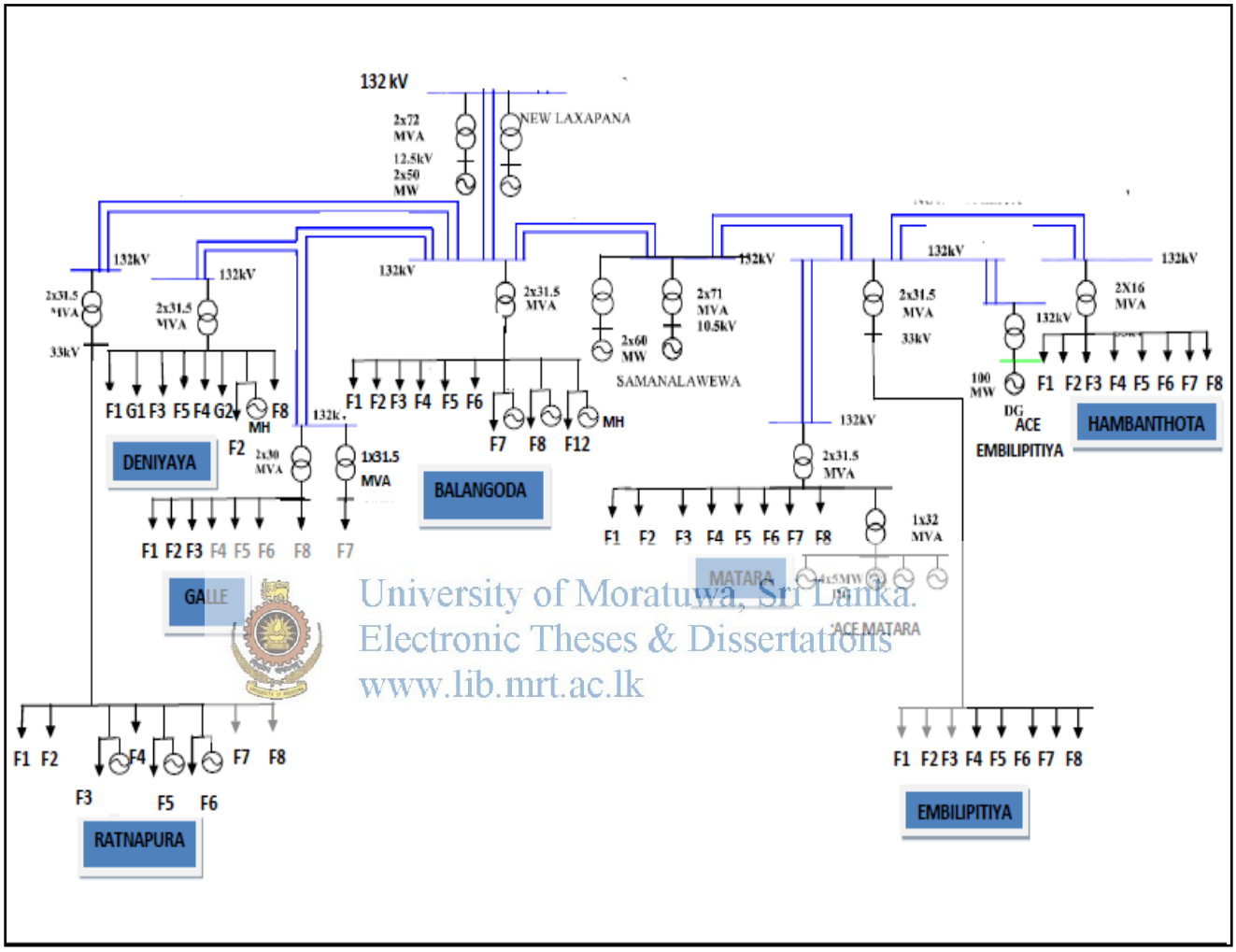
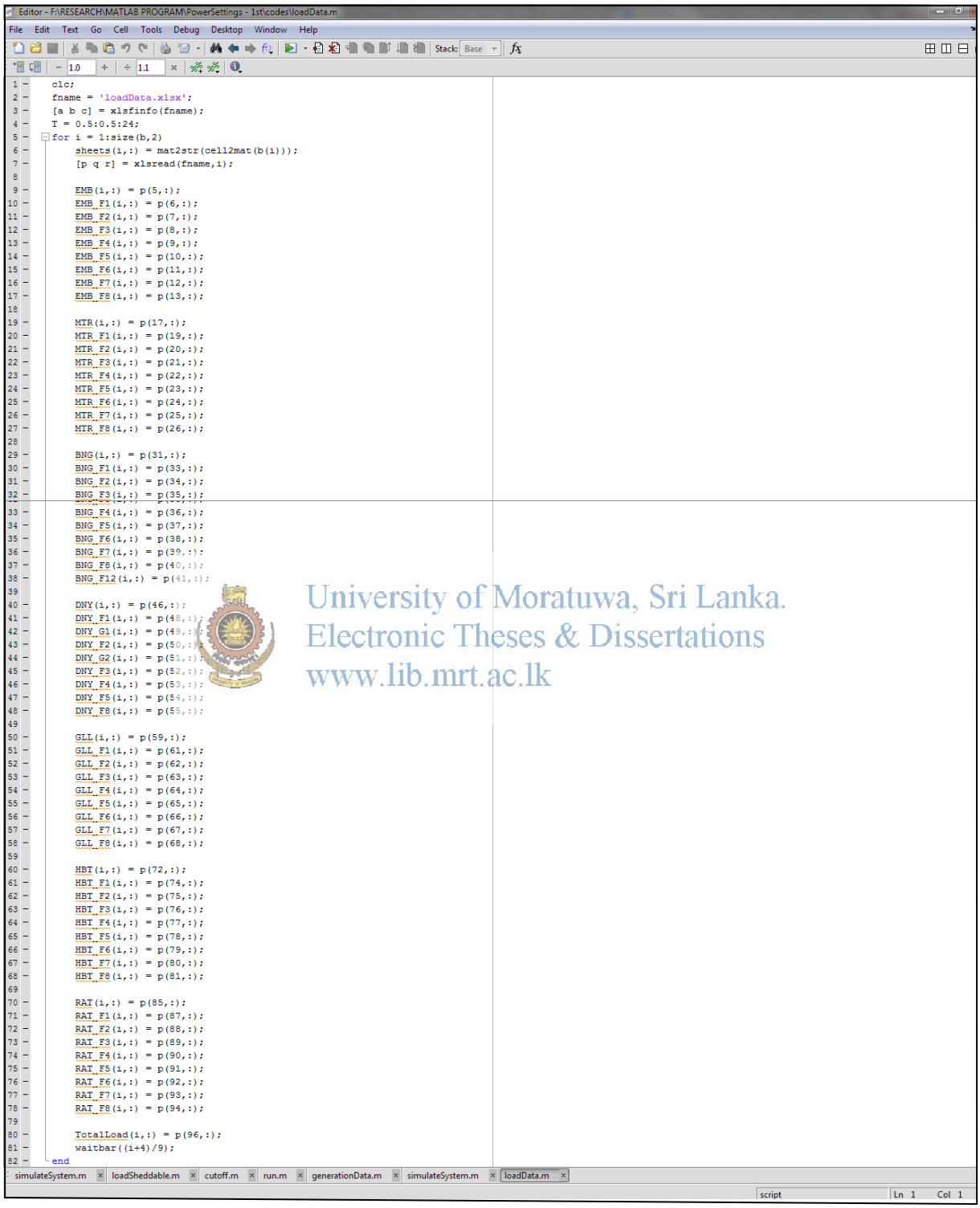
APPENDICES

Appendix-A: Selected reduced network from CEB system.

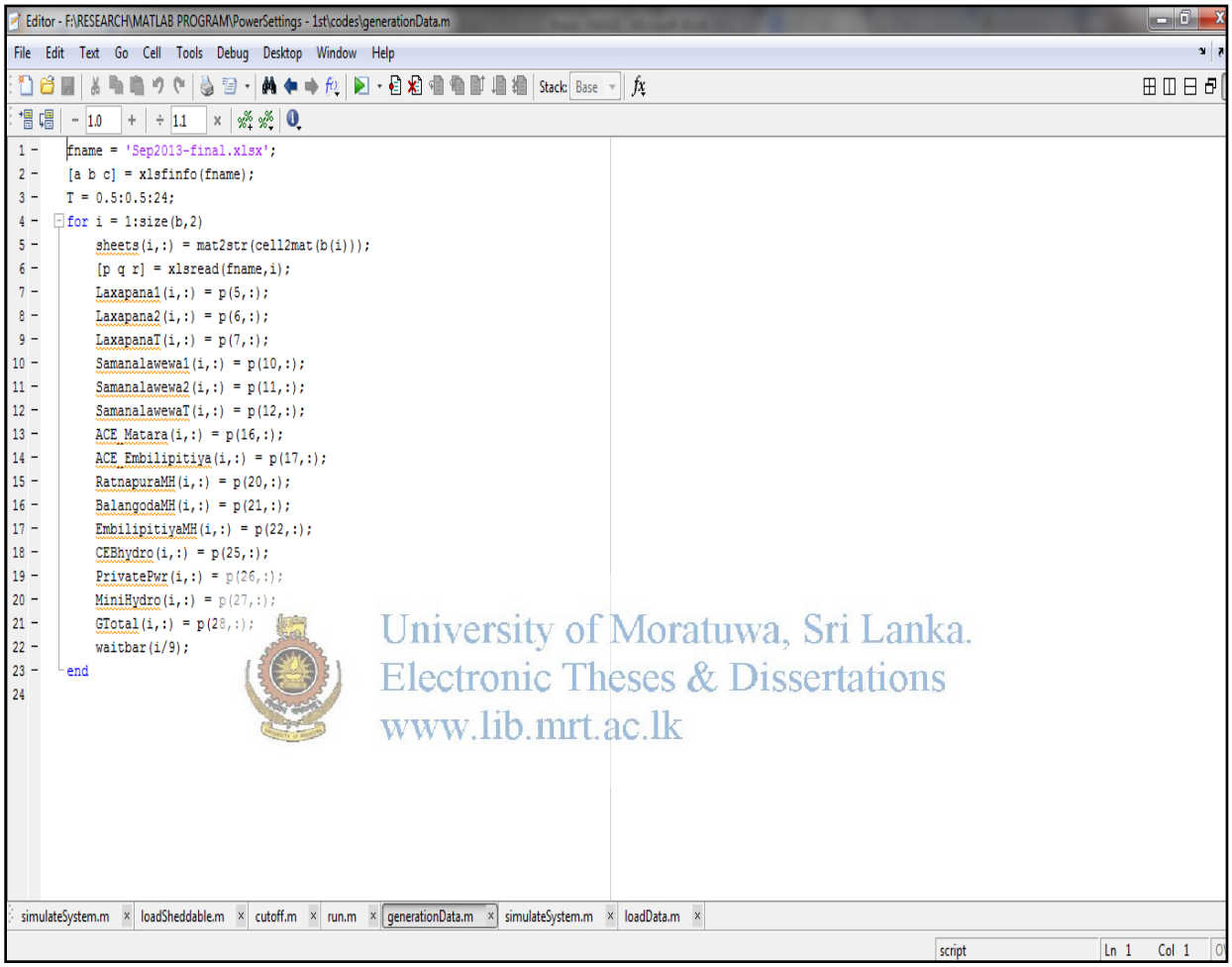


Appendix-B: 'loadData.m' file created in MATLAB software to read demand in each GSS from excel file.



```
clc;
fname = 'loadData.xlsx';
[a b c] = xlsfinfo(fname);
T = 0.5:0.5:24;
for i = 1:size(b,2)
    sheets(i,:) = mat2str(cell2mat(b(i)));
    [p q r] = xlsread(fname,i);

    EMB(i,:) = p(5,:);
    EMB_F1(i,:) = p(6,:);
    EMB_F2(i,:) = p(7,:);
    EMB_F3(i,:) = p(8,:);
    EMB_F4(i,:) = p(9,:);
    EMB_F5(i,:) = p(10,:);
    EMB_F6(i,:) = p(11,:);
    EMB_F7(i,:) = p(12,:);
    EMB_F8(i,:) = p(13,:);

    MTR(i,:) = p(17,:);
    MTR_F1(i,:) = p(19,:);
    MTR_F2(i,:) = p(20,:);
    MTR_F3(i,:) = p(21,:);
    MTR_F4(i,:) = p(22,:);
    MTR_F5(i,:) = p(23,:);
    MTR_F6(i,:) = p(24,:);
    MTR_F7(i,:) = p(25,:);
    MTR_F8(i,:) = p(26,:);

    BNG(i,:) = p(31,:);
    BNG_F1(i,:) = p(33,:);
    BNG_F2(i,:) = p(34,:);
    BNG_F3(i,:) = p(35,:);
    BNG_F4(i,:) = p(36,:);
    BNG_F5(i,:) = p(37,:);
    BNG_F6(i,:) = p(38,:);
    BNG_F7(i,:) = p(39,:);
    BNG_F8(i,:) = p(40,:);
    BNG_F12(i,:) = p(41,:);

    DNY(i,:) = p(46,:);
    DNY_F1(i,:) = p(48,:);
    DNY_G1(i,:) = p(49,:);
    DNY_F2(i,:) = p(50,:);
    DNY_G2(i,:) = p(51,:);
    DNY_F3(i,:) = p(52,:);
    DNY_F4(i,:) = p(53,:);
    DNY_F5(i,:) = p(54,:);
    DNY_F8(i,:) = p(55,:);

    GLL(i,:) = p(59,:);
    GLL_F1(i,:) = p(61,:);
    GLL_F2(i,:) = p(62,:);
    GLL_F3(i,:) = p(63,:);
    GLL_F4(i,:) = p(64,:);
    GLL_F5(i,:) = p(65,:);
    GLL_F6(i,:) = p(66,:);
    GLL_F7(i,:) = p(67,:);
    GLL_F8(i,:) = p(68,:);

    HBT(i,:) = p(72,:);
    HBT_F1(i,:) = p(74,:);
    HBT_F2(i,:) = p(75,:);
    HBT_F3(i,:) = p(76,:);
    HBT_F4(i,:) = p(77,:);
    HBT_F5(i,:) = p(78,:);
    HBT_F6(i,:) = p(79,:);
    HBT_F7(i,:) = p(80,:);
    HBT_F8(i,:) = p(81,:);

    RAT(i,:) = p(85,:);
    RAT_F1(i,:) = p(87,:);
    RAT_F2(i,:) = p(88,:);
    RAT_F3(i,:) = p(89,:);
    RAT_F4(i,:) = p(90,:);
    RAT_F5(i,:) = p(91,:);
    RAT_F6(i,:) = p(92,:);
    RAT_F7(i,:) = p(93,:);
    RAT_F8(i,:) = p(94,:);

    TotalLoad(i,:) = p(96,:);
    waitbar((i+4)/9);
end
```

Appendix-C: 'generationData.m' file created in MATLAB software to read generation at each power station from excel file.



Appendix-D: 'gui.m' file created in MATLAB software to view 'GRAPHICAL USER INTERFACE'.

Editor - F:\RESEARCH\MATLAB PROGRAM\PowerSettings - 1st\codes\gui.m

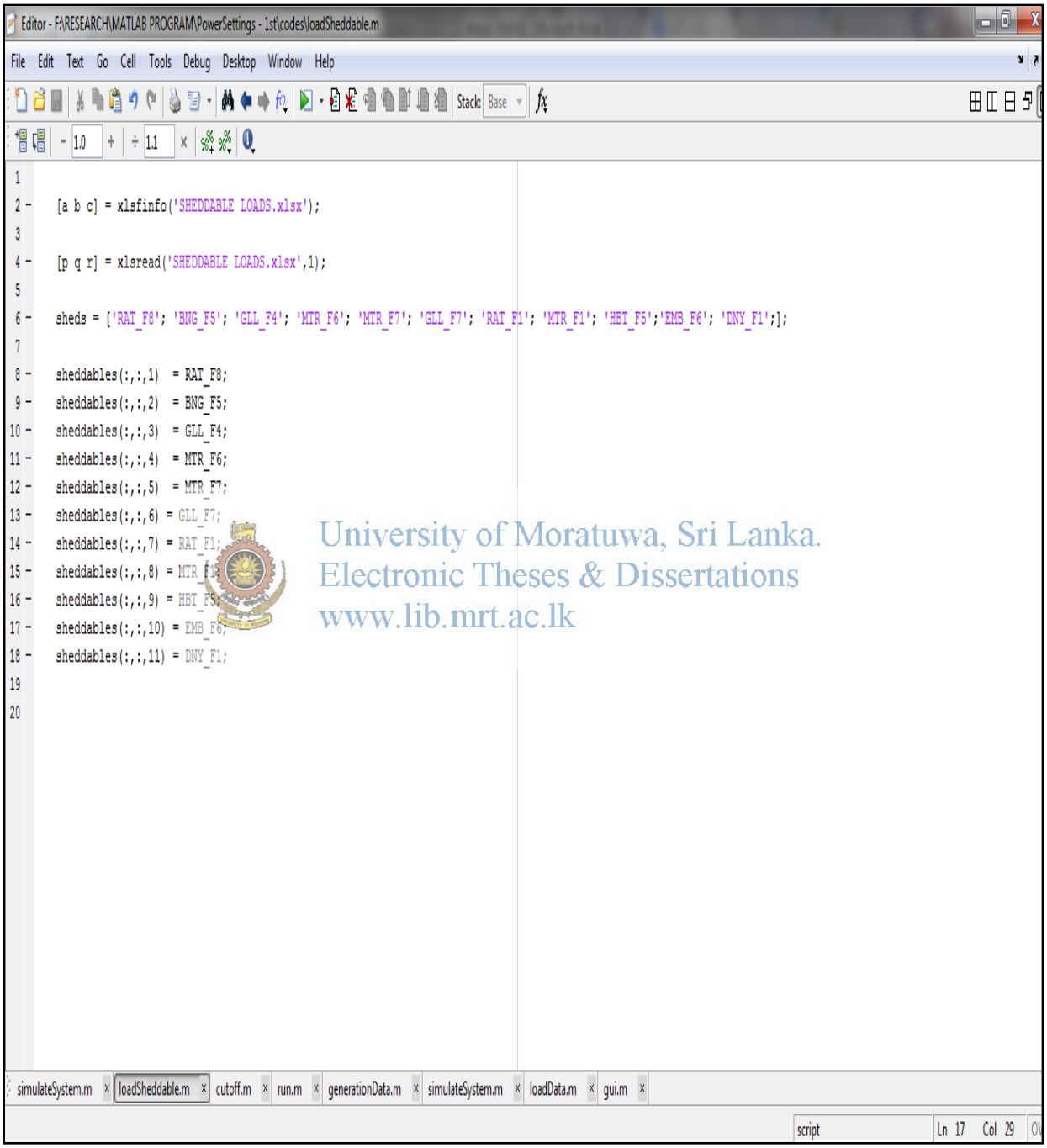
File Edit Text Go Cell Tools Debug Desktop Window Help

```
uimain = figure(...
    'Units', 'Normalized'...
    ,'Position',[0.01 0.12, 0.98, 0.7]...
    ,'Name','Load Shedding Simulator','NumberTitle','off');

mainPanel = uipanel(...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[.01 .01 .98 .98]);

datePanel = uipanel(...
    'Parent',mainPanel,...
    'Title','Set Date',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[.01 .75 .18 .24]);


radDate = uibuttongroup(...
    'Parent',datePanel,...
    'Units', 'Normalized',...
    'visible','off','Position',[0 0 1 1]);
u0 = uicontrol('Style','Radio','String','Sunday',...
    'Units', 'Normalized',...
    'pos',[0 0.91 1 0.14],'parent',radDate,'HandleVisibility','off');
u1 = uicontrol('Style','Radio','String','Monday',...
    'Units', 'Normalized',...
    'pos',[0 0.76 1 0.14],'parent',radDate,'HandleVisibility','off');
u2 = uicontrol('Style','Radio','String','Tuesday',...
    'Units', 'Normalized',...
    'pos',[0 0.61 1 0.14],'parent',radDate,'HandleVisibility','off');
u3 = uicontrol('Style','Radio','String','Wednesday',...
    'Units', 'Normalized',...
    'pos',[0 0.46 1 0.14],'parent',radDate,'HandleVisibility','off');
u4 = uicontrol('Style','Radio','String','Thursday',...
    'Units', 'Normalized',...
    'pos',[0 0.31 1 0.14],'parent',radDate,'HandleVisibility','off');
u5 = uicontrol('Style','Radio','String','Friday',...
    'Units', 'Normalized',...
    'pos',[0 0.16 1 0.14],'parent',radDate,'HandleVisibility','off');
u6 = uicontrol('Style','Radio','String','Saturday',...
    'Units', 'Normalized',...
    'pos',[0 0.01 1 0.14],'parent',radDate,'HandleVisibility','off');
%set(radDate,'SelectionChangeFcn',@selcbk);
set(radDate,'SelectedObject',u0);  % No selection
set(radDate,'Visible','on');

resPanel = uipanel(...
    'Parent',mainPanel,...
    'Title','Set Resolution (minutes)',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[.21 .81 .18 .18]);
res = uicontrol(...
    'Parent',resPanel,...
    'Style','edit',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[0 0 1 1]);

spdPanel = uipanel(...
    'Parent',mainPanel,...
    'Title','Set Update Speed(miliseconds)',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[.41 .81 .18 .18]);
spd = uicontrol(...
    'Parent',spdPanel,...
    'Style','edit',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[0 0 1 1]);


dispOptPanel = uipanel(...
    'Parent',mainPanel,...
    'Title','Set Display Options',...
    'Units', 'Normalized',...
    'BackgroundColor','white',...
    'Position',[.61 .81 .18 .18]);
ldVgen = uicontrol(...
    'Parent',dispOptPanel, 'Style','checkbox',...
    'String','Load vs Generation',...
    'Units', 'Normalized', 'BackgroundColor','white',...
    'Position',[0 0.85 1 .18]);
genWgss = uicontrol(...
    'Parent',dispOptPanel, 'Style','checkbox',...
    'String','Operation of Power Plants vs Time',...
```

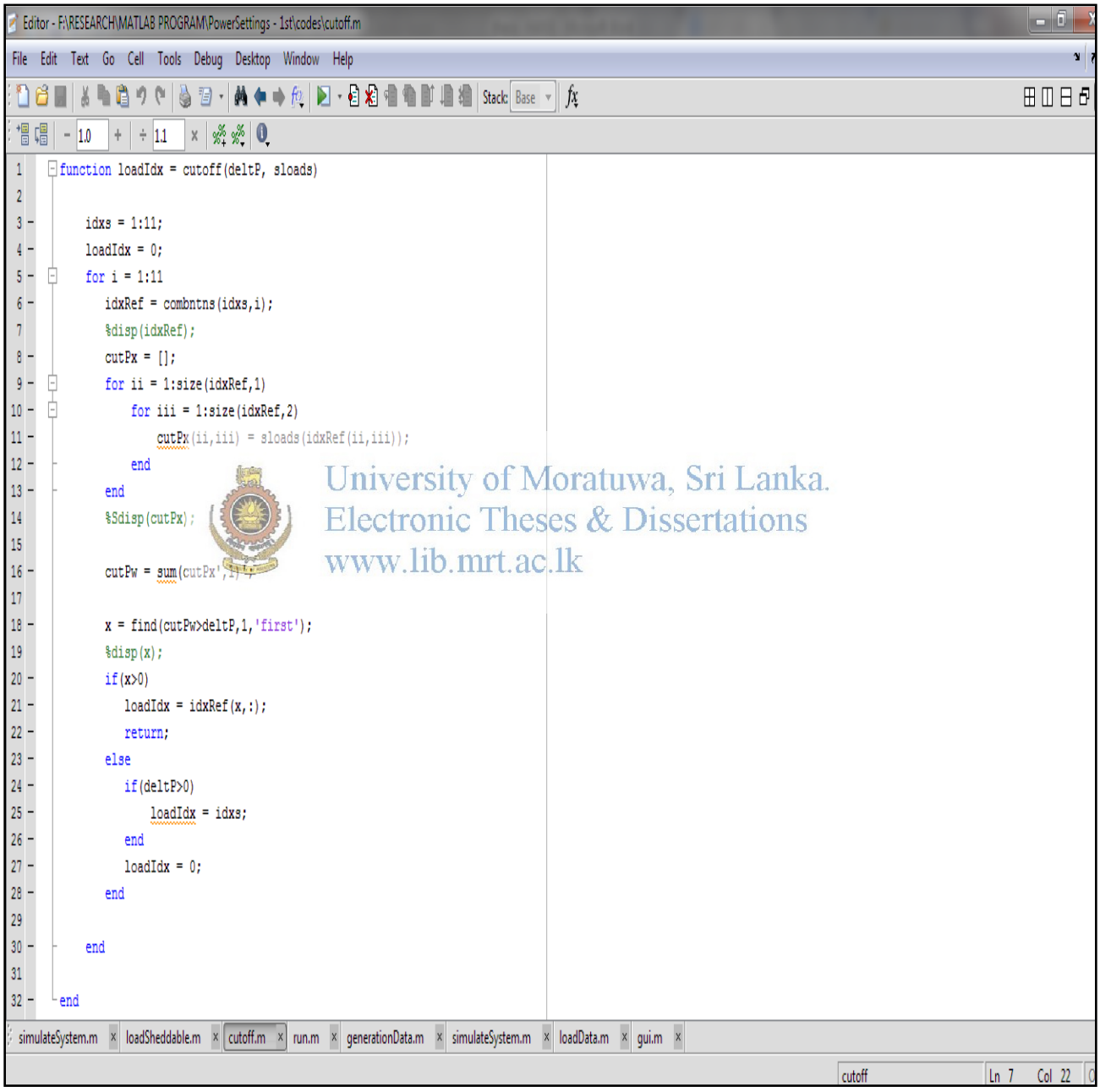
```
90          'Units', 'Normalized', 'BackgroundColor','white',...
91          'Position',[0 0.65 1 .18]);
92      ldVfdr = uicontrol(...
93          'Parent',dispOptPanel, 'Style','checkbox',...
94          'String','Demand vs GSS',...
95          'Units', 'Normalized', 'BackgroundColor','white',...
96          'Position',[0 0.45 1 .18]);
97      freqs = uicontrol(...
98          'Parent',dispOptPanel, 'Style','checkbox',...
99          'String','System Frequency',...
100         'Units', 'Normalized', 'BackgroundColor','white',...
101         'Position',[0 0.25 1 .18]);
102     fdrSht = uicontrol(...
103         'Parent',dispOptPanel, 'Style','checkbox',...
104         'String','Feeder Shutdowns',...
105         'Units', 'Normalized', 'BackgroundColor','white',...
106         'Position',[0 0.05 1 .18]);
107
108     uipanel(...
109         'Parent',mainPanel,...
110         'Title','Options',...
111         'Units', 'Normalized',...
112         'BackgroundColor','white',...
113         'Position',[.81 .81 .18 .18]);
114
115     onOffPanel = uipanel(...
116         'Parent',mainPanel,...
117         'Title','Power Plants ...
118         'Units', 'Normalized...
119         'BackgroundColor','w...
120         'Position',[.01 .15 .98 .66]);
121
122     columnname =   {'Power Plants', 'Time Pairs'};
123     columnformat = {'char', 'char'};
124     columneditable =  [false true];
125     tbl = uitable(...
126         'Parent',onOffPanel,...
127         'Units','normalized',...
128         'Data',gssData,...
129         'Position',[0.01 0.01 0.98 0.98],...
130         'ColumnName', columnname,...
131         'ColumnFormat', columnformat,...
132         'ColumnEditable', columneditable,...
133         'ColumnWidth',{150,1100},...
134         'Interruptible', 'off',...
135         'RowName','');
136
137
138     simulator = uicontrol(...
139         'Parent',mainPanel, 'Style','pushbutton',...
140         'String','Simulate',...
141         'Units', 'Normalized',...
142         'Callback', 'simulateSystem',...
143         'Position',[0.84 0.12 0.08 .05]);
144
145
```

simulateSystem.m | loadSheddable.m | cutoff.m | run.m | generationData.m | simulateSystem.m | loadData.m | gui.m

Appendix-E: 'loadSheddable.m' file created in MATLAB software to read demand of each GSS feeder which can be shed from excel file.



Appendix-F: 'cutoff.m' file created in MATLAB software to define 'cutoff' function for load shedding.



Appendix-G: 'simulateSystem.m' file created in MATLAB software for the simulation.

Editor - F:\RESEARCH\MATLAB PROGRAM\PowerSettings\codes\simulateSystem.m

File Edit Text Go Cell Tools Debug Desktop Window Help

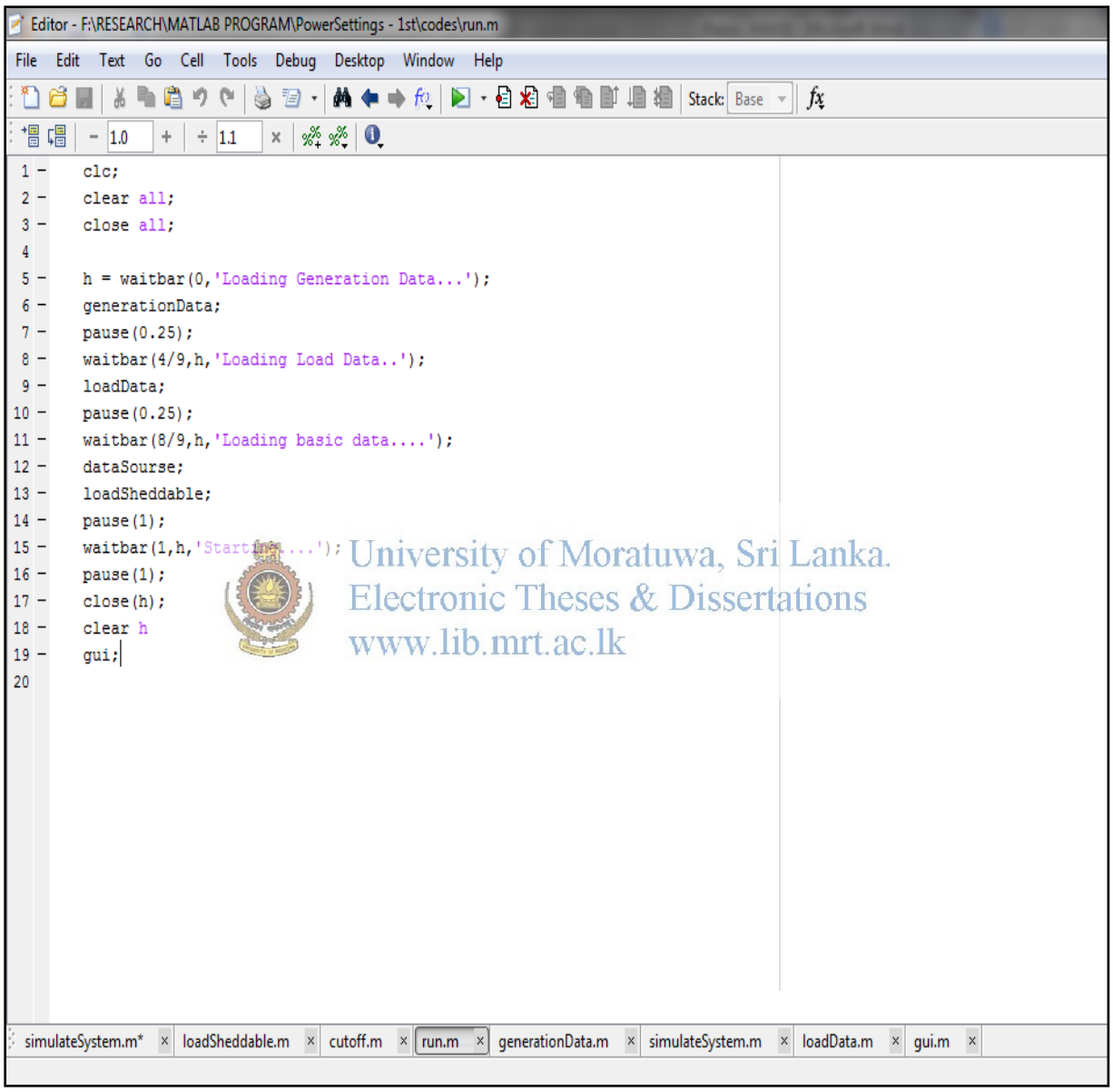
```
vbl = get(radDate,'SelectedObject');
if(vbl == u0)
    date = 1;
elseif (vbl == u6)
    date = 3;
else
    date = 2;
end

resVal = get(res,'string');
disp(resVal);
try
    resVal = str2double(resVal);
catch Exception
    resVal = 30;
end
if isnan(resVal)
    resVal = 30;
end



updateRate = get(spd,'string');
disp(updateRate);
try
    updateRate = str2double(updateRate)/1000;
catch Exception
    updateRate = 0.1;
end
if isnan(updateRate)
    updateRate = 0.1;
end

tbldata = get(tbl,'data');
lx1 = 1+floor(str2num(tbldata{1,2})/30);
lx2 = 1+floor(str2num(tbldata{2,2})/30);
sw1 = 1+floor(str2num(tbldata{3,2})/30);
sw2 = 1+floor(str2num(tbldata{4,2})/30);
ac1 = 1+floor(str2num(tbldata{5,2})/30);
ac2 = 1+floor(str2num(tbldata{6,2})/30);



deflt = [0 0];
%if(lx1~= 0)
    for i = 1:2:size(lx1,2)
        GTotal(date,lx1(i):lx1(i+1)) = GTotal(date,lx1(i):lx1(i+1)) - Laxapana1(date,lx1(i):lx1(i+1));
        Laxapana1(date,lx1(i):lx1(i+1)) = 0;
    end
%end
%if(lx2~= 0)
    for i = 1:2:size(lx2,2)
        GTotal(date,lx2(i):lx2(i+1)) = GTotal(date,lx2(i):lx2(i+1)) - Laxapana2(date,lx2(i):lx2(i+1));
        Laxapana2(date,lx2(i):lx2(i+1)) = 0;
    end
%end
%if(sw1~= 0)
    for i = 1:2:size(sw1,2)
        GTotal(date,sw1(i):sw1(i+1)) = GTotal(date,sw1(i):sw1(i+1)) - Samanalawewa1(date,sw1(i):sw1(i+1));
        Samanalawewa1(date,sw1(i):sw1(i+1)) = 0;
    end
%end
%if(sw2~= 0)
    for i = 1:2:size(sw2,2)
        GTotal(date,sw2(i):sw2(i+1)) = GTotal(date,sw2(i):sw2(i+1)) - Samanalawewa2(date,sw2(i):sw2(i+1));
        Samanalawewa2(date,sw2(i):sw2(i+1)) = 0;
    end
%end
%if(ac1~= 0)
    for i = 1:2:size(ac1,2)
        GTotal(date,ac1(i:i+1)) = GTotal(date,ac1(i):ac1(i+1)) - ACE_Matara(date,ac1(i):ac1(i+1));
        ACE_Matara(date,ac1(i):ac2(i+1)) = 0;
    end
%end
%if(ac2~= 0)
    for i = 1:2:size(ac2,2)
        GTotal(date,ac2(i):ac2(i+1)) = GTotal(date,ac2(i):ac2(i+1)) - ACE_Embilipitiya(date,ac2(i):ac2(i+1));
        ACE_Embilipitiya(date,ac2(i):ac2(i+1)) = 0;
    end
%end

resVal = resVal/60;
p = size(T,2);
x = 0.5:resVal:0.5*p;
GTotalyy = spline(T,GTotal(:,1:48),x);
TotalLoadyy = spline(T,TotalLoad(:,1:48),x);
deltP = (TotalLoadyy(date,:) - GTotalyy(date,:));

ff1 = cast(deltP>0,'double');
ff2 = cast(deltP<=0,'double');

deltP = (TotalLoadyy(date,:) - GTotalyy(date,:));
```

```
    t0 = size(x,2);
    map = ones(11,t0);
    savedP = zeros(1,t0);
    detP = (TotalLoadyy(date,:) + savedP - GTotalyy(date,:))./GTotalyy(date,:);
    fnew = 50*ones(size(detP));

        dfdt = detP*50/(2*2.92);
        fnew = fnew - dfdt*(resVal);
        ff1 = cast(fnew<50,'double');
        ff2 = cast(fnew>=50,'double');
        fnew = (50*ones(size(detP)).*ff2) + fnew.*ff1;
for k = 1:48
        if (dfdt(k) >= 0.85 && fnew(k) <= 49.0)
            sloads = sheddables(date,k,:);
            cutIdxs = cutoff(deltP(k), sloads);
            disp(cutIdxs);
            if(cutIdxs~=0)
              for txd = 1:size(cutIdxs,2)
                    map(txd,k) = 0;
              end
              savedP(k) = sum(sloads(cutIdxs));
            end
        elseif (fnew(k) <= 48.75)
             pause(0.001);
             if (fnew(k) <= 48.75)
               sloads = sheddables(date,k,:);
               cutIdxs = cutoff(deltP(k), sloads);
               disp(cutIdxs);
              if(cutIdxs~=0)
                for txd = 1:size(cutIdxs,2)
                     map(txd,k) = 0;
                end
                savedP(k) = sum(sloads(cutIdxs));
              end
            end
            if (fnew(k) >= 50)
               cutIdxs = 0;
            end
        end
end



    detP = (TotalLoadyy(date,:) + savedP - GTotalyy(date,:))./GTotalyy(date,:);

    fnew = 50*ones(size(detP));
    dfdt = detP*50/(2*2.92);
    fnew = fnew - dfdt*(resVal);
    ff1 = cast(fnew<50,'double');
    ff2 = cast(fnew>=50,'double');
    fnew = (50*ones(size(detP)).*ff2) + fnew.*ff1;
    Laxapanalyy = spline(T,Laxapana1(:,1:48),x);
    Laxapana2yy = spline(T,Laxapana2(:,1:48),x);
    Samanalawewa1yy = spline(T,Samanalawewa1(:,1:48),x);
    Samanalawewa2yy = spline(T,Samanalawewa2(:,1:48),x);
    ACE_Matarayy = spline(T,ACE_Matara(:,1:48),x);
    ACE_Embilipitiyayy = spline(T,ACE_Embilipitiya(:,1:48),x);

    BNGyy = spline(T,BNG(:,1:48),x);
    DNYyy = spline(T,DNY(:,1:48),x);
    EMByy = spline(T,EMB(:,1:48),x);
    GLLyy = spline(T,GLL(:,1:48),x);
    HBTyy = spline(T,HBT(:,1:48),x);
    MTRyy = spline(T,MTR(:,1:48),x);
    RATyy = spline(T,RAT(:,1:48),x);

    figure(...
        'Units', 'Normalized'...
        ,'Position',[0.01 0.12, 0.98, 0.76]...
        ,'Name','Simulation Plot Window','NumberTitle','off');

    noPlots = 0;

        if(get(ldVgen,'Value'))
            noPlots = noPlots + 1;
        end

        if(get(genWgss,'Value'))
            noPlots = noPlots + 1;
        end

        if(get(ldVfdr,'Value'))
            noPlots = noPlots + 1;
        end

        if(get(freqs,'Value'))
            noPlots = noPlots + 1;
        end
```

```
182
183 -         if(get(fdrSht,'Value'))
184 -             noPlots = noPlots + 1;
185 -         end
186
187 -     for k = 0:t0
188
189 -         plotid = 0;
190 -         if(get(ldVgen,'Value'))
191 -            plotid = plotid + 1;
192 -            subplot(noPlots,1,plotid);
193 -            plot(x(i:k),GTotalyy(date,1:k));
194 -            hold on
195 -            plot(x(i:k),TotalLoadyy(date,1:k) - savedP(1:k),'-g');
196 -            plot(x(i:k),TotalLoadyy(date,1:k),'-r');
197 -            legend('Total Generation','Balance after Shedding', 'Total Load',2);
198 -            hold off
199 -            title('Load vs Generation');
200 -            xlabel('time (hour)');
201 -            ylabel('Power (MW)');
202 -            xlim([0 25]);
203 -         end
204
205 -         if(get(genWgss,'Value'))
206 -            plotid = plotid + 1;
207 -            subplot(noPlots,1,plotid);
208 -            plot(x(i:k),Laxapana1yy(date,1:k),'-c');
209 -            hold on
210 -            plot(x(i:k),Laxapana2yy(date,1:k),'-m');
211 -            plot(x(i:k),Samanalawewa1yy(date,1:k),'-k');
212 -            plot(x(i:k),Samanalawewa2yy(date,1:k),'-g');
213 -            plot(x(i:k),ACE_Matarayy(date,1:k),'-b');
214 -            plot(x(i:k),ACE_Embilipitiyayy(date,1:k),'-r');
215 -            hold off
216 -            xlabel('time (hour)');
217 -            ylabel('Power (MW)');
218 -            xlim([0 25]);
219 -            ylim([-1 55]);
220 -            title('Operation of Power Plants vs Time');
221 -         end
222
223 -         if(get(ldVfdr,'Value'))
224 -            plotid = plotid + 1;
225 -            subplot(noPlots,1,plotid);
226 -            plot(x(i:k),BNGyy(date,1:k),'-c');
227 -            hold on
228 -            plot(x(i:k),BNFyy(date,1:k),'-m');
229 -            plot(x(i:k),BNEyy(date,1:k),'-k');
230 -            plot(x(i:k),BNDyy(date,1:k),'-g');
231 -            plot(x(i:k),HOTyy(date,1:k),'-b');
232 -            plot(x(i:k),MATyy(date,1:k),'-r');
233 -            plot(x(i:k),RATyy(date,1:k),'-y');
234 -            hold off
235 -            xlabel('time (hour)');
236 -            ylabel('Power (MW)');
237 -            xlim([0 25]);
238 -            ylim([-1 75]);
239 -            title('Demand vs GSS');
240 -         end
241 -         if(get(freqs,'Value'))
242 -            plotid = plotid + 1;
243 -            subplot(noPlots,1,plotid);
244 -            plot(x(i:k),fnew(1:k),'-c');
245 -            xlabel('time (hour)');
246 -            ylabel('Frequency (Hz)');
247 -            xlim([0 25]);
248 -            ylim([40 60]);
249 -            title('System Frequency');
250 -         end
251 -         if(get(fdrSht,'Value'))
252 -            plotid = plotid + 1;
253 -             subplot(noPlots,1,plotid);
254 -             mpr = map(:,1:k);
255 -             if(size(mpr,2) > 1)
256 -                 spy(mpr);
257 -                 axis fill
258 -                 set(gca,'XTickLabel', ' ', 'YTick', 1:11,'YTickLabel',sheds,...
259                       'GridLineStyle','-','XGrid','on','YGrid','on');
260 -                 xlim([-4 t0+9]);
261 -             end
262 -            title('Feeder Shutdowns');
263 -         end
264 -         pause(updateRate);
265 -     end
```

simulateSystem.m* | loadSheddable.m | cutoff.m | run.m | generationData.m | simulateSystem.m | loadData.m | gui.m

Appendix-H: 'run.m' file created in MATLAB software to run the simulation.



Appendix-I: Load Shedding Sequence used in ILS mechanism for PSS/E simulation.

Bus no.	FEEDER	ID	P(MW)	Q(MVAr)	Subtotal of P (MW)	
3580	KOTUG-3-12 33.000	2	15.6000	3.5487	**15.6000**	
3650	GALLE-3-4 33.000	3	15.5000	2.4983	**31.1000**	
3770	KIRIB-3-2 33.000	1	15.5000	2.4983	**46.6000**	
3600	BOLAW-3-4 33.000	3	13.6500	7.1152	**60.2500**	
3530	THULH-3-4 33.000	3	12.2500	1.9745	**72.5000**	
3600	BOLAW-3-8 33.000	5	11.5500	6.0206	**84.0500**	
3520	NUWAR-3-2 33.000	2	11.5000	7.8875	**95.5500**	
3890	DEHIW_3-1 33.000	1	11.3500	6.1628	**106.9000**	
3790	RATMA-3A-9 33.000	5	11.2500	6.9830	**118.1500**	
3820	ATURU-3-8 33.000	3	11.2000	4.7115	**129.3500**	
3420	HORANA_3-3 33.000	2	11.1500	7.6475	**140.5000**	
3200	UKUWE-3-10 33.000	3	11.0500	3.0694	**151.5500**	
4920	SUB C-11 11.000	1	10.4000	4.8000	**161.9500**	
3570	BIYAG-3-7 33.000	7	10.0000	4.4810	**171.9500**	
3580	KOTUG-3-3 33.000	1	10.0000	2.2748	**181.9500**	
3705	NEWANU-3-(4 and5) 33.000	1	10.0000	1.6118	**191.9500**	
3260	MAHIYANGE-3-2 33.000	1	9.6000	1.5473	**201.5500**	
3570	BIYAG-3-5 33.000	5	9.5000	4.2570	**211.0500**	
3680	KURUN-3-6 33.000	5	9.5000	1.5312	**220.5500**	
3560	PANNI-3-7 33.000	6	9.4000	4.4593	**229.9500**	
3590	SAPUG-3A-7 33.000	5	9.3000	6.3786	**239.2500**	
4435	COL_A_11-1011 11.000	4	9.2000	4.4700	**248.4500**	CASE STUDY-1
3790	RATMA-3A-2 33.000	1	9.0500	5.6175	**257.5000**	
3860	MADAM-3-7 33.000	5	9.0000	2.5206	**266.5000**	
3900	PANNAL-4 33.000	3	8.9500	2.8647	**275.4500**	
4430	COL_I_11-18 11.000	1	8.9000	4.5670	**284.3500**	
4435	COL_A_11-22 11.000	3	8.9000	3.5000	**293.2500**	CASE STUDY-4
3770	KIRIB-3-4 33.000	3	8.9000	1.4345	**302.1500**	CASE STUDY-2
3850	PANAD-3-2 33.000	1	8.8000	2.4444	**310.9500**	
3670	MATARA-3-2 33.000	2	8.5000	2.7206	**319.4500**	
3860	MADAM-3-2 33.000	2	8.5000	2.3805	**327.9500**	
3570	BIYAG-3-4 33.000	4	8.2500	3.6969	**336.2000**	
3150	AMPA-3-3 33.00	1	8.1000	1.3056	**344.3000**	
3570	BIYAG-3-8 33.000	8	8.0000	3.5848	**352.3000**	
3770	KIRIB-3-7 33.000	5	8.0000	1.2894	**360.3000**	
3650	GALLE-3-5 33.000	4	7.9000	2.8176	**368.2000**	
3620	BADUL-3-3 33.000	2	7.8500	1.7857	**376.0500**	
3910	ANIYA-5 33.000	3	7.7500	3.9689	**383.8000**	
3560	PANNI-3-9 33.000	8	7.6000	3.6054	**391.4000**	

Bus no.	FEEDER	ID	P(MW)	Q(MVAr)	**Subtotal of P(MW)**
3830	VEYAN-33-4 33.000	2	7.5000	2.1005	**398.9000**
3600	BOLAW-3-3 33.000	2	7.4000	3.8573	**406.3000**
3690	HABAR-3-7 33.000	5	7.4000	1.1927	**413.7000**
3620	BADUL-3-5 33.000	3	7.3000	1.6606	**421.0000**
3705	NEWANU-3-(6and7) 33.000	2	7.2500	1.1686	**428.2500**
3800	MATUG-3-10 33.000	6	7.2500	1.1686	**435.5000**
3520	NUWAR-3-1 33.000	1	7.0000	4.8011	**442.5000**
3600	BOLAW-3-2 33.000	1	7.0000	3.6488	**449.5000**
3830	VEYAN-33-3 33.000	1	7.0000	1.9605	**456.5000**
3150	AMPA-3-5 33.00	2	7.0000	1.1283	**463.5000**
3770	KIRIB-3-6 33.000	4	7.0000	1.1283	**470.5000**
4435	COL_A_11-14 11.000	2	6.8800	3.3000	**477.3800**
3200	UKUWE-3-12 33.000	4	6.8500	1.9028	**484.2300**
3840	JPURA_3-6 33.000	6	6.8000	3.0471	**491.0300**
3551	KOLON-3B-G1 33.000	1	6.8000	1.9044	**497.8300**
3340	BELIATT-3-4 33.000	1	6.8000	1.0960	**504.6300**
3590	SAPUG-3A-3 33.000	2	6.7500	4.6296	**511.3800**
3690	HABAR-3-4 33.000	3	6.7500	1.0880	**518.1300**
3670	MATARA-3-7 33.000	5	6.7000	2.1445	**524.8300**
3551	KOLON-3B-G2 33.000	2	6.6000	1.8484	**531.4300**
3690	HABAR-3-3 33.000	2	6.6000	1.0638	**538.0300**
3670	MATARA-3-4 33.000	3	6.5000	2.0805	**544.5300**
3580	KOTUG-3-13 33.000	3	6.5000	1.4786	**551.0300**
3581	KOTU_NEW-3-9 33.000	1	6.5000	1.4786	**557.5300**
3890	DEHIW_3-8 33.000	5	6.4000	3.4751	**563.9300**
3910	ANIYA-7 33.000	4	6.4000	3.2776	**570.3300**
4430	COL_I_11-1240 11.000	3	6.2000	3.3000	**576.5300**
3880	AMBALA-6 33.000	4	6.2000	2.7782	**582.7300**
4750	COL_E-11-10 11.000	2	6.2000	1.9000	**588.9300**
3910	ANIYA-3 33.000	2	6.1000	3.1239	**595.0300**
3581	KOTU_NEW-3-11 33.000	2	6.1000	1.3876	**601.1300**
3680	KURUN-3-3 33.000	2	6.0500	0.9751	**607.1800**
3440	KATUNA-3-1 33.000	1	6.0000	2.6886	**613.1800**
3500	KOSGA-3-1 33.000	1	6.0000	2.6886	**619.1800**
3500	KOSGA-3-2 33.000	2	6.0000	2.6886	**625.1800**
3770	KIRIB-3-14 33.000	6	6.0000	0.9671	**631.1800**
3790	RATMA-3A-7 33.000	4	5.9500	3.6932	**637.1300**
3340	BELIATT-3-6 33.000	3	5.9000	0.9510	**643.0300**
3870	K-NIYA-3-2 33.000	2	5.8500	4.0124	**648.8800**
3900	PANNAL-2 33.000	1	5.8500	1.8724	**654.7300**

CASE STUDY-3

Bus no.	FEEDER	ID	P(MW)	Q(MVAr)	**Subtotal of P(MW)**
4435	COL_A_11-1137 11.000	1	5.6700	2.1110	**660.4000**
3880	AMBALA-3 33.000	2	5.6500	2.5318	**666.0500**
3590	SAPUG-3A-11 33.000	8	5.5500	3.8066	**671.6000**
3510	SITHA-33-6 33.000	4	5.5000	3.0556	**677.1000**
4430	COL_I_11-45 11.000	2	5.4000	1.2000	**682.5000**
3560	PANNI-3-2 33.000	1	5.3500	2.5380	**687.8500**
3420	HORANA_3-4 33.000	3	5.3000	3.6351	**693.1500**
3800	MATUG-3-9 33.000	5	5.2500	0.8462	**698.4000**
3240	VAVUN-33-4 33.000	3	5.1500	0.8301	**703.5500**
3870	K-NIYA-3-1 33.000	1	5.1000	3.4979	**708.6500**
3790	RATMA-3A-3 33.000	2	5.1000	3.1656	**713.7500**
3680	KURUN-3-2 33.000	1	5.1000	0.8220	**718.8500**
3570	BIYAG-3-1 33.000	1	5.0000	2.2405	**723.8500**
3860	MADAM-3-3 33.000	3	5.0000	1.4003	**728.8500**
3650	GALLE-3-1 33.000	1	5.0000	0.8059	**733.8500**
3690	HABAR-3-1 33.000	1	5.0000	0.8059	**738.8500**
3890	DEHIW_3-7 33.000	4	4.9500	2.6878	**743.8000**
4430	COL_I_11-602 11.000	5	4.9171	1.3330	**748.7171**
3890	DEHIW_3-6 33.000	3	4.8500	2.6335	**753.5671**
4760	COL_F-11-624 11.000	3	4.7800	1.9800	**758.3471**
3620	BADUL-3-6 33.000	4	4.7000	1.0692	**763.0471**
3740	RATNAP-3-1 33.000	1	4.6000	2.0613	**767.6471**
3420	HORANA_3-5 33.000	4	4.5500	3.1207	**772.1971**
3670	MATARA-3-8 33.000	6	4.5500	1.4563	**776.7471**
4750	COL_E-11-609 11.000	3	4.5500	1.1000	**781.2971**
3510	SITHA-33-1 33.000	1	4.5000	2.5000	**785.7971**
4430	COL_I_11-1130 11.000	4	4.5000	1.3846	**790.2971**
3680	KURUN-3-4 33.000	3	4.5000	0.7253	**794.7971**
4435	COL_A_11-571 11.000	5	4.4776	1.0591	**799.2747**
3600	BOLAW-3-5 33.000	4	4.4000	2.2936	**803.6747**
3560	PANNI-3-4 33.000	3	4.3500	2.0636	**808.0247**
3880	AMBALA-4 33.000	3	4.3000	1.9268	**812.3247**
3500	KOSGA-3-8 33.000	4	4.2500	1.9044	**816.5747**
3530	THULH-3-5 33.000	4	4.2500	0.6850	**820.8247**
3440	KATUNA-3-7 33.000	3	4.2000	1.8820	**825.0247**
3840	JPURA_3-5 33.000	5	4.1500	1.8596	**829.1747**
3530	THULH-3-1 33.000	1	4.1000	0.6608	**833.2747**
3510	SITHA-33-2 33.000	2	4.0000	2.2222	**837.2747**
3820	ATURU-3-6 33.000	2	4.0000	1.6827	**841.2747**
3860	MADAM-3-4 33.000	4	4.0000	1.1203	**845.2747**

Bus no.	FEEDER	ID	P(MW)	Q(MVAr)	**Subtotal of P(MW)**
3850	PANAD-3-3 33.000	2	4.0000	1.1111	**849.2747**
4750	COL_E-11-335 11.000	4	4.0000	1.0000	**853.2747**
3800	MATUG-3-8 33.000	4	3.8500	0.6205	**857.1247**
3670	MATARA-3-6 33.000	4	3.7500	1.2003	**860.8747**
3260	MAHIYANGE 3-5 33.000	2	3.7500	0.6044	**864.6247**
3900	PANNAL-7 33.000	6	3.7000	1.1843	**868.3247**
3720	KILINOCH-3-2 33.000	1	3.6500	1.9819	**871.9747**
3560	PANNI-3-6 33.000	5	3.6500	1.7315	**875.6247**
3640	DENIY-3-1 33.000	1	3.6000	0.5802	**879.2247**
3590	SAPUG-3A-8 33.000	6	3.5500	2.4348	**882.7747**
4760	COL_F-11-54 11.000	2	3.4800	2.5600	**886.2547**
3590	SAPUG-3A-6 33.000	4	3.4500	2.3663	**889.7047**
3440	KATUNA-3-8 33.000	4	3.3500	1.5011	**893.0547**
3690	HABAR-3-8 33.000	6	3.3000	0.5319	**896.3547**
3560	PANNI-3-8 33.000	7	3.2000	1.5181	**899.5547**
4750	COL_E-11-981 11.000	1	3.2000	0.5000	**902.7547**
3530	THULH-3-2 33.000	2	3.1000	0.4997	**905.8547**
3820	ATURU-3-3 33.000	1	3.0000	1.2620	**908.8547**
3650	GALLE-3-6 33.000	5	3.0000	1.0700	**911.8547**
3590	SAPUG-3A-9 33.000	7	2.9000	1.9890	**914.7547**
3880	AMBALA-2 33.000	1	2.9000	1.2995	**917.6547**
3240	VAVUN-33-1 33.000	1	2.8500	0.4594	**920.5047**
3900	PANNAL-5 33.000	4	2.7500	0.8802	**923.2547**
3650	GALLE-3-2 33.000	2	2.7500	0.4432	**926.0047**
3690	HABAR-3-6 33.000	4	2.7500	0.4432	**928.7547**
3620	BADUL-3-1 33.000	1	2.7000	0.6142	**931.4547**
3551	KOLON-3B-B1 33.000	3	2.6500	0.7422	**934.1047**
3720	KILINOCH-3-4 33.000	2	2.5000	1.3575	**936.6047**
4760	COL_F-11-116 11.000	1	2.5000	0.8000	**939.1047**
3530	THULH-3-6 33.000	5	2.5000	0.4029	**941.6047**
3720	KILINOCH-3-5 33.000	3	2.4500	1.3303	**944.0547**
3900	PANNAL-6 33.000	5	2.4500	0.7842	**946.5047**
4760	COL_F-11-43 11.000	4	2.4000	0.6000	**948.9047**
3830	VEYAN-33-6 33.000	3	2.2500	0.6301	**951.1547**
3800	MATUG-3-5 33.000	2	2.1500	0.3465	**953.3047**
3551	KOLON-3B-B2 33.000	4	2.1000	0.5881	**955.4047**
3830	VEYAN-33-8 33.000	5	2.0000	0.5601	**957.4047**
3840	JPURA_3-2 33.000	2	1.8500	0.8290	**959.2547**
4760	COL_F-11-9 11.000	5	1.8400	0.5600	**961.0947**
3590	SAPUG-3A-4 33.000	3	1.6000	1.0974	**962.6947**

Bus no.	FEEDER	ID	P(MW)	Q(MVAr)	**Subtotal of P(MW)**
3570	BIYAG-3-6 33.000	6	1.5000	0.6722	**964.1947**
3840	JPURA_3-4 33.000	4	1.3500	0.6049	**965.5447**
3590	SAPUG-3A-2 33.000	1	1.3000	0.8916	**966.8447**
3800	MATUG-3-6 33.000	3	1.3000	0.2095	**968.1447**
3790	RATMA-3A-6 33.000	3	1.2500	0.7759	**969.3947**
3850	PANAD-3-5 33.000	4	1.2500	0.3472	**970.6447**
3240	VAVUN-33-6 33.000	4	1.1500	0.1854	**971.7947**
3420	HORANA_3-2 33.000	1	1.1000	0.7545	**972.8947**
3240	VAVUN-33-2 33.000	2	1.1000	0.1773	**973.9947**
3640	DENIY-3-2 33.000	2	1.1000	0.1773	**975.0947**
3800	MATUG-3-1 33.000	1	1.1000	0.1773	**976.1947**
3520	NUWAR-3-6 33.000	5	1.0000	0.6859	**977.1947**
3570	BIYAG-3-3 33.000	3	1.0000	0.4481	**978.1947**
3830	VEYAN-33-7 33.000	4	1.0000	0.2801	**979.1947**
3860	MADAM-3-1 33.000	1	1.0000	0.2801	**980.1947**
3340	BELIATT-3-5 33.000	2	1.0000	0.1612	**981.1947**
3840	JPURA_3-8 33.000	7	0.9500	0.4257	**982.1447**
3440	KATUNA-3-2 33.000	2	0.9000	0.4033	**983.0447**
3560	PANNI-3-3 33.000	2	0.3500	0.2609	**983.5947**
3510	SITHA-33-5 33.000	3	0.5000	0.2778	**984.0947**
3560	PANNI-3-5 33.000	4	0.3000	0.1423	**984.3947**
3770	KIRIB-3-3 33.000	2	0.2500	0.0403	**984.6447**
3670	MATARA-3-1 33.000	1	0.1000	0.0320	**984.7447**
3200	UKUWE-3-1 33.000	1	0.0000	0.0000	**984.7447**
3200	UKUWE-3-3 33.000	2	0.0000	0.0000	**984.7447**
3500	KOSGA-3-5 33.000	3	0.0000	0.0000	**984.7447**
3560	PANNI-3-10 33.000	9	0.0000	0.0000	**984.7447**
3680	KURUN-3-5 33.000	4	0.0000	0.0000	**984.7447**
3840	JPURA_3-1 33.000	1	0.0000	0.0000	**984.7447**
3850	PANAD-3-4 33.000	3	0.0000	0.0000	**984.7447**
3870	K-NIYA-3-3 33.000	3	0.0000	0.0000	**984.7447**
3890	DEHIW_3-3 33.000	2	0.0000	0.0000	**984.7447**
3900	PANNAL-3 33.000	2	0.0000	0.0000	**984.7447**
3910	ANIYA-1 33.000	1	0.0000	0.0000	**984.7447**
3520	NUWAR-3-4 33.000	3	-1.0000	-0.6859	**983.7447**