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LAMPIRAN

Lampiran 1 *Coding* Program MATLAB Pembentukan Sinyal Masukan SPWM

```
clear all; clc;
%%% modulating signal
Am=36;
fm=50;
Wm=2*pi*fm;
t=0:1E-07:1;
Vm=Am*sin(Wm*t);
subplot(3,1,1);
Vabs=abs(Vm)a;
plot(t,Vm);
%%% triangular carrier signal
Ac = 0.99*Am;
fc = 1000;
Tc = 1/fc;
Vc = 0.5*Ac*sawtooth(2*pi*fc*(t-0.5*Tc),0.5)+0.5*Ac;
subplot(3,1,2);
plot(t,Vc,t,Vabs);
%%% SPWM signal
for k=1:size(Vabs,2);
 if Vabs(k)>Vc(k)
   if Vm(k)>0
     Vspwm(k) = Am;
   else
     Vspwm(k) = -Am;
   end
 else
   Vspwm(k) = 0;
end;
end
subplot(3,1,3);
plot(t,Vspwm);
```

Lampiran 2 *Coding* Program MATLAB Identifikasi Perubahan ω_n dengan Sinyal Masukan SPWM

```
yin=Vspwm;
Zeta=0.07;
Wn=([100*pi 105*pi 110*pi 115*pi 120*pi 130*pi]);
for m=1:size(Wn,2)
filt=tf([5 (Wn(m))^2],[1 2*Zeta*Wn(m) (Wn(m))^2]); %filter as
transfer function
yo(:,m)=lsim(filt,Vspwm,t); %voltage output function
plot(t,Vspwm,t,yo); hold on %to hold the figure untuk finishing
the loop
end
figure(2)
grid;
plot(t,yin,'k-',t,yo(:,1),'k--',t,yo(:,2),'k-
.',t,yo(:,3),'k:',t,yo(:,4),'r-',t,yo(:,5),'r--',t,yo(:,6),'r-.')
grid;
grid minor;
ax = gca
ax.YColor = 'r';
ax.XColor = 'r';
xlabel('Time (S)');
ylabel('Voltage (V)');
title('System Response on Variable Wn');
legend('Vin','Vout (Wn=100pi)','Vout (Wn=105pi)','Vout
(Wn=110pi)','Vout (Wn=115pi)','Vout (Wn=120pi)','Vout
(Wn=130pi)');
```

Lampiran 3 *Coding* Program MATLAB Identifikasi Perubahan ζ dengan Sinyal Masukan SPWM

```
yin=Vspwm;
Wn=100*pi;
par=([0.05 0.06 0.07 0.08 0.09 0.1]);
for k=1:size(par,2)
filt=tf([5 Wn^2],[1 2*par(k)*Wn Wn^2]); %filter as transfer
function
yo(:,k)=lsim(filt,yin,t); %voltage output function
%plot(t,yin,t,yo); hold on %to hold the figure untuk finishing the
loop in
%one figure
end
figure(2)
plot(t,yin,'k-',t,yo(:,1),'k--',t,yo(:,2),'k-
.',t,yo(:,3),'k:',t,yo(:,4),'r-',t,yo(:,5),'r--',t,yo(:,6),'r-.')
grid;
xlabel('Time (S)');ylabel('Voltage (V)');
title('System Response on Variable Zeta');
legend('Vin','Vout (Zeta=0.05)','Vout (Zeta=0.06)','Vout
(Zeta=0.07)','Vout (Zeta=0.08)','Vout (Zeta=0.09)','Vout
(Zeta=0.1)');
```

Lampiran 4 *Coding* Program MATLAB Penyelesaian Persamaan dengan Metode Iterasi Jacobi untuk Skenario dengan Damper

```
clear all; clc;
a1=51;
a0=1.3E+05;
b1=5;
b0=a0;
RL=50;
x(1,:)=[0.1 0.2 0.3];
Nmax=9;
for k = 1:Nmax
CF=x(k,1);
LF=x(k,2);
RD=x(k,3);
f1=(RL*CF*RD)+LF-(a1*CF*LF*RD)-(a1*RL*CF*LF);
f2=(RL*CF*RD)-(b1*CF*LF*RD)-(b1*RL*CF*LF);
f3=RL-(a0*CF*LF*RD)-(RL*b0*CF*LF);
f=[f1; f2; f3];
df1x1=(RL*RD)-(a1*LF*RD)-(a1*RL*LF);
df1x2=1-(a1*CF*RD)-(a1*RL*CF);
df1x3=(RL*CF)-(a1*CF*LF);
df2x1=(RL*RD)-(b1*LF*RD)-(b1*RL*LF);
df2x2=-(b1*CF*RD)-(b1*RL*CF);
df2x3=(RL*CF)-(b1*CF*LF);
df3x1=-(a0*LF*RD)-(RL*a0*LF);
df3x2=-(a0*CF*RD)-(RL*a0*CF);
df3x3=-(a0*CF*LF);
J=[df1x1 df1x2 df1x3;
df2x1 df2x2 df2x3;
df3x1 df3x2 df3x3];
xnew=x(k,:)'-inv(J)*f;
x(k+1,:)=xnew';
end
t=1:size(x,1);
plot(t,x(:,1),'kx--',t,x(:,2),'k+-.',t,x(:,3),'ko:');
legend('CF','LF','RD');
xlabel('Iteration');
ylabel('Parameter Values');
CFK=x(Nmax,1)
LFK=x(Nmax,2)
RDK=x(Nmax,3)
F1K=(RL*CFK*RDK)+LFK-(a1*CFK*LFK*RDK)-(a1*RL*CFK*LFK)
F2K=(RL*CFK*RDK)-(b1*CFK*LFK*RDK)-(b1*RL*CFK*LFK)
F3K=RL-(a0*CFK*LFK*RDK)-(RL*b0*CFK*LFK)
```

```
CFK = 4.3401e-04
LFK =  0.0177
RDK =  0.0886
F1K =  0
F2K =  0
F3K =  0
```

Lampiran 5 *Coding* Program MATLAB Penyelesaian Persamaan dengan Metode Iterasi Jacobi untuk Skenario dengan Damper

```
clear all;
clc;
a1=51;
a0=1.3E+05;
RL=100;
x(1,:)=[0.01 0.02];
Nmax=9;
for k = 1:Nmax
CF=x(k,1);
LF=x(k,2);
f1=LF-(a1*RL*CF*LF);
f2=RL-(RL*a0*CF*LF);
f=[f1; f2];
df1x1=-(a1*RL*LF);
df1x2=1-(a1*RL*CF);
df2x1=-(RL*a0*LF);
df2x2=-(RL*a0*CF);
J=[df1x1 df1x2;
df2x1 df2x2];
xnew=x(k,:)'-inv(J)*f;
x(k+1,:)=xnew';
end
t=1:size(x,1);
figure(2);
plot(t,x(:,1),'kx--',t,x(:,2),'k+-.');
legend('CF','LF');
xlabel('Iteration');
ylabel('Parameter Values');
title('Parameter Searching Using Jacobian Method');
%x(Nmax,1),x(Nmax,2)
CFK=x(Nmax,1)
LFK=x(Nmax,2)
F1K=LFK-(a1*RL*CFK*LFK)
F2K=RL-(RL*a0*CFK*LFK)
```

```
CFK =
   1.9608e-04

LFK =
    0.0392

F1K =
     0

F2K =
     0
```

Lampiran 6 *Coding* Program MATLAB Plot Bode

```
clear all; clc;
% Related Work Satu [39] (a1)
CFa1=300E-06;
LFa1=80E-03;
RDa1=6;
RLa1=50;
filta1=tf([((CFa1*RDa1*RLa1)/((CFa1*LFa1)*(RDa1+RLa1)))
RLa1/((CFa1*LFa1)*(RDa1+RLa1))],[1
((CFa1*RDa1*RLa1)+LFa1)/((CFa1*LFa1)*(RDa1+RLa1))
RLa1/((CFa1*LFa1)*(RDa1+RLa1))]);
% Related Work Dua [38] (a2)
CFa2=0.175E-06;
LFa2=85E-03;
RLa2=33;
filta2=tf([RLa2/(CFa2*LFa2*RLa2)],[1 LFa2/(CFa2*LFa2*RLa2)
RLa2/(CFa2*LFa2*RLa2)]);
% Related Work Tiga [37] (a3)
CFa3=550E-06;
LFa3=80E-03;
RLa3=170;
filta3=tf([RLa3/(CFa3*LFa3*RLa3)],[1 LFa3/(CFa3*LFa3*RLa3)
RLa3/(CFa3*LFa3*RLa3)]);
% Proposed Method Satu [b1]
CFb1=499E-06;
LFb1=20E-03;
RDb1=0.1002;
RLb1=50;
filtb1=tf([((CFb1*RDb1*RLb1)/((CFb1*LFb1)*(RDb1+RLb1)))
RLb1/((CFb1*LFb1)*(RDb1+RLb1))],[1
((CFb1*RDb1*RLb1)+LFb1)/((CFb1*LFb1)*(RDb1+RLb1))
RLb1/((CFb1*LFb1)*(RDb1+RLb1))]);
% Proposed Method Dua [b2]
CFb2=300E-06;
LFb2=80E-03;
RDb2=6;
RLb2=500;
filtb2=tf([((CFb2*RDb2*RLb2)/((CFb2*LFb2)*(RDb2+RLb2)))
RLb2/((CFb2*LFb2)*(RDb2+RLb2))],[1
((CFb2*RDb2*RLb2)+LFb2)/((CFb2*LFb2)*(RDb2+RLb2))
RLb2/((CFb2*LFb2)*(RDb2+RLb2))]);
% Magnitude and Phase Value
w=logspace(1,5,500);
[m1,p1]=bode(filta1,w);
mag1(:)=m1(1,1,:);
ph1(:)=p1(1,1,:);
[m2,p2]=bode(filta2,w);
mag2(:)=m2(1,1,:);
ph2(:)=p2(1,1,:);
[m3,p3]=bode(filta3,w);
mag3(:)=m3(1,1,:);
ph3(:)=p3(1,1,:);
```

```
[m4,p4]=bode(filtb1,w);
mag4(:)=m4(1,1,:);
ph4(:)=p4(1,1,:);
[m5,p5]=bode(filtb2,w);
mag5(:)=m5(1,1,:);
ph5(:)=p5(1,1,:);
% Subplot
subplot(2,1,1);
grid;
grid minor;
semilogx(w,mag3,'k--',w,mag2,'k-.',w,mag1,'k:',w,mag4,'r--
',w,mag5,'r:');
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
ylabel('Magnitude (dB)');
subplot(2,1,2);
grid;
grid minor;
semilogx(w,ph3,'k--',w,ph2,'k-.',w,ph1,'k:',w,ph4,'r--
',w,ph5,'r:');
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
ylabel('Phase (deg)');
xlabel('Frequency (rad/s)');
```

Lampiran 7 *Netlist* Program PSpice Tanggapan Waktu dari Rangkaian Inverter Satu Fasa + Filter LC + Damper R_D + Beban R_L dengan SPWM

```
Inverter dgn POWER MOSFET + Dioda dgn FILTER LC + DAMPER R + BEBAN
Vs  1 0 {DCIN}     ; DC input voltage
Vy  1 2 0V         ; Sebagai sensor arus masukan
Cin 2 0 100u
M1  2 3 4 4 IRFP460; Power MOSFET dengan model IRFP460
M2  4 5 0 0 IRFP460
M3  2 6 7 7 IRFP460
M4  7 8 0 0 IRFP460
.MODEL IRFP460 NMOS (VTO=2.831 KP=31.2u L=1u W=30m CGDO=3.358N
CGSO=18.054N)
D1  4 2 DIN750
D2  0 4 DIN750
D3  7 2 DIN750
D4  0 7 DIN750
.MODEL DIN750 D(Is = 880.5E-18 Rs = .25 Ikf = 0 N = 1 Xti = 3 Eg =
1.11
+Cjo= 175p M=0.5516 Vj = .75 FC=.5 Isr= 1.859n Nr=2 Bv=4.7
Ibv=20.245m
+Nbv= 1.6989 Ibvl= 1.9556m Nbvl= 14.976)
**************** Load
RLOAD 18 7 {RL}
**************** Filter
Vz   4   19  0V         ; Sebagai sensor arus filter masukan
L1  19   18 {LF1}
*CF  18  17 {CFF}
*RD  17  7  {RD}
CF  18  17  {CFF}
Vc  17  7   0V
************* parameter-parameter **************
***Konfigurasi filter tanpa damper
*.PARAM LF1=550mH CFF=80uF RL=170
*.PARAM LF1=0.175mH CFF=85uF RL=33
.PARAM LF1=80mH CFF=300uF RL=50
*.PARAM LF1=20mH CFF=499uF RL=50
*.PARAM LF1=40mH CFF=249.5uF RL=100
***Konfigurasi filter dengan damper
*.PARAM LF1=80mH CFF=300uF RD=6 RL=50
*.PARAM LF1=20mH CFF=499uF RD=0.1002 RL=50
*.PARAM LF1=40mH CFF=249.5uF RD=0.2004 RL=100
.PARAM fout=50Hz ; frekuensi teg luaran
.PARAM P=11      ; jumlah pulsa per setengah perioda
.PARAM M=0.9     ; magnitudo teg carrier
.PARAM DCIN=36V  ; sumber teg DC
*****************************************
V_mod 16 0 AC 0 SIN (0 {M} {fout} 0 0 0); modulating signal
frequency
E_ABS 15 0 VALUE {ABS(V(16))} ; nilai mutlak sinyal carrier
V_ref 14 0 PULSE (1 0 0 {1/(2*{2*{p}*{fout}})}
{1/(2*{2*{p}*{fout}})-1ns} 1ns {1/{2*{p}*{fout}}}); sinyal gigi
gergaji (pemodulasi)
```

```
Vx    13 0 PULSE (0 1 0 1ns 1ns {1/(2*{fout})-2ns} {1/{fout}})
EVx_INV 12 0 VALUE {1-V(13)} ; Inverter
E_ABM21 11 0 VALUE {IF(V(15)-V(14)> 0,1,0)} ;
E_MULT1 9  0 VALUE {V(11)*V(13)} ; Multiplier 1
E_MULT2 10 0 VALUE {V(11)*V(12)} ; Multiplier 2
*** Voltage controlled voltage source (DRIVER)
E1 3 4 9  0 36
E2 5 0 10 0 36
E3 6 7 10 0 36
E4 8 0 9  0 36
** Simulasi
.TRAN 1US 500mS 0 1us UIC; Transient Analysis
.FOUR 50Hz 100 V(18,7) I(RLOAD) ; Fourier Analysis
**.OPTIONS ABSTOL=1uA CHGTOL=0.1uC RELTOL=0.1 VNTOL=0.1
.OP
*.PROBE I(Vy) V(1,0) I(RLOAD) I(L1) V(4,7) V(18,7) V(14,0) V(13,0)
V(15,0)  V(16,0)  V(9,0) V(10,0) V(11,0) V(12,0)
*.PROBE I(L1) V(4,7) I(RLOAD) V(18,7) I(RD) V(17,7)
.PROBE I(L1) V(4,7) I(RLOAD) V(18,7) I(Vc)
*.PROBE I(Vy) V(1,0) I(RLOAD) I(L1) V(4,7) V(3,4) V(5,0) V(8,0)
V(6,7) V(18,7) V(9,0) V(10,0)
.END
```

Lampiran 8 *Coding* MATLAB Visualisasi Tanggapan Waktu Tegangan Keluaran dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan SPWM

```
y1=importdata('SPWM_INV_FILT_LC_[37]_VIN-OUT.txt');
x1=y1(:,1);
z1=y1(:,3);
y2=importdata('SPWM_INV_FILT_LC_[38]_VIN-OUT.txt');
x2=y2(:,1);
z2=y2(:,3);
y3=importdata('SPWM_INV_FILT_LC_[39]_VIN-OUT.txt');
x3=y3(:,1);
z3=y3(:,3);
y4=importdata('SPWM_INV_FILT_LC_B1_VIN-OUT.txt');
x4=y4(:,1);
z4=y4(:,3);
y5=importdata('SPWM_INV_FILT_LC_B2_VIN-OUT.txt');
x5=y5(:,1);
z5=y5(:,3);
figure(4);
plot(x1,z1,'k--',x2,z2,'k-.',x3,z3,'k:',x4,z4,'r--',x5,z5,'r:');
grid on; grid minor;
%title('Time Analysis of Output Voltage for SPWM VSI with LC
Filter');
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
xlabel('Time (s)');
ylabel('Voltage (V)');
```

Lampiran 9 *Coding* MATLAB Visualisasi Tanggapan Waktu Arus Keluaran dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan SPWM

```
y1=importdata('SPWM_INV_FILT_LC_[37]_I-IN-OUT.txt');
x1=y1(:,1);
z1=y1(:,3);
y2=importdata('SPWM_INV_FILT_LC_[38]_I-IN-OUT.txt');
x2=y2(:,1);
z2=y2(:,3);
y3=importdata('SPWM_INV_FILT_LC_[39]_I-IN-OUT.txt');
x3=y3(:,1);
z3=y3(:,3);
y4=importdata('SPWM_INV_FILT_LC_B1_I-IN-OUT.txt');
x4=y4(:,1);
z4=y4(:,3);
y5=importdata('SPWM_INV_FILT_LC_B2_I-IN-OUT.txt');
x5=y5(:,1);
z5=y5(:,3);
figure(1);
plot(x1,z1,'k--',x2,z2,'k-.',x3,z3,'k:',x4,z4,'r--',x5,z5,'r:');
grid on; grid minor;
%title('Time Analysis of Output Current for SPWM VSI with LC
Filter');
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
xlabel('Time (s)');
ylabel('Current (Amp)');
```

Lampiran 10 *Coding* MATLAB Visualisasi Komponen Fourier terhadap Orde Harmonisa Tegangan Keluaran dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan SPWM

```
y1=importdata('SPWM_INV_FILT_LC_[37]_VTHD.txt');
x1=y1(:,1);
z1=y1(:,2);
z2=y1(:,3);
y2=importdata('SPWM_INV_FILT_LC_[38]_VTHD.txt');
x2=y2(:,1);
z3=y2(:,2);
z4=y2(:,3);
y3=importdata('SPWM_INV_FILT_LC_[39]_VTHD.txt');
x3=y3(:,1);
z5=y3(:,2);
z6=y3(:,3);
y4=importdata('SPWM_INV_FILT_LC_B1_VTHD.txt');
x4=y4(:,1);
z7=y4(:,2);
z8=y4(:,3);
y5=importdata('SPWM_INV_FILT_LC_B2_VTHD.txt');
x5=y5(:,1);
z9=y5(:,2);
z10=y5(:,3);
figure(1);
plot(x1,z2,'k--*',x2,z4,'k-.x',x3,z6,'k:o',x4,z8,'r--
+',x5,z10,'r:o');
grid on; grid minor;
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
xlabel('Harmonic Order');
ylabel('Fourier Component');
%title('Frequency Responses of Output Voltage for SPWM VSI with LC
Filter');
```

Lampiran 11 *Coding* MATLAB Visualisasi Komponen Fourier terhadap Orde Harmonisa Arus Keluaran dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan SPWM

```
y1=importdata('SPWM_INV_FILT_LC_[37]_ITHD.txt');
x1=y1(:,1);
z1=y1(:,2);
z2=y1(:,3);
y2=importdata('SPWM_INV_FILT_LC_[38]_ITHD.txt');
x2=y2(:,1);
z3=y2(:,2);
z4=y2(:,3);
y3=importdata('SPWM_INV_FILT_LC_[39]_ITHD.txt');
x3=y3(:,1);
z5=y3(:,2);
z6=y3(:,3);
y4=importdata('SPWM_INV_FILT_LC_B1_ITHD.txt');
x4=y4(:,1);
z7=y4(:,2);
z8=y4(:,3);
y5=importdata('SPWM_INV_FILT_LC_B2_ITHD.txt');
x5=y5(:,1);
z9=y5(:,2);
z10=y5(:,3);
figure(6);
plot(x1,z2,'k--*',x2,z4,'k-.x',x3,z6,'k:o',x4,z8,'r--
+',x5,z10,'r:o');
grid on; grid minor;
legend('[37]','[38]','[39]','Skenario Satu','Skenario Dua');
xlabel('Harmonic Order');
ylabel('Fourier Component');
%title('Frequency Responses of Output Voltage for SWP VSI with LC
Filter');
```

Lampiran 12 *Netlist* Program PSpice Tanggapan Frekuensi dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan Masukan Sinyal SPWM

```
Analisis Tanggapan Frekuensi Filter LC + Damper R + Beban R
VS 1 0 AC {MAG} 0
L1 1 2 {LF1}
CF 2 3 {CF1}
*RD 3 0 {RDAMP}
VC 3 0  0V
RL 2 0 {RLOAD}
.PARAM MAG=36
***Konfigurasi filter tanpa damper
*.PARAM LF1=550mH CF1=80uF RLOAD=170
*.PARAM LF1=0.175mH CF1=85uF RLOAD=33
*.PARAM LF1=80mH CF1=300uF RLOAD=50
*.PARAM LF1=20mH CF1=499uF RLOAD=50
*.PARAM LF1=40mH CF1=249.5uF RLOAD=100
***Konfigurasi filter tanpa damper (new value)
.PARAM LF1=19.6mH CF1=392.16uF RLOAD=50
*.PARAM LF1=39.2mH CF1=196.08uF RLOAD=100
***Konfigurasi filter dengan damper
*.PARAM LF1=20mH CF1=499uF RDAMP=0.1002 RLOAD=50
*.PARAM LF1=40mH CF1=249.5uF RDAMP=0.2004 RLOAD=100
.AC DEC 100000 10Hz 100Hz
*.PROBE  V(1,0) V(1,2) I(L1) V(2,3) V(3,0) I(RD) V(2,0) I(RL)
.PROBE V(1,0) V(1,2) I(L1) V(2,3) I(VC) V(2,0) I(RL)
.END
```

Lampiran 13 *Coding* MATLAB Visualisasi Tanggapan Frekuensi dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan SPWM

```
y1=importdata('[39]-FREK_P-RMS_P-OUT_LC_FILT-R_LOAD.txt');
x1=y1(:,1);
z1=y1(:,2);
z2=y1(:,3);
y2=importdata('[39]-FREK_P-RMS_P-DISP_LC_FILT-R_LOAD.txt');
x2=y2(:,1);
z3=y2(:,2);
z4=y2(:,3);
y3=importdata('B01-FREK_P-RMS_P-OUT_LC_FILT-R_LOAD.txt');
x3=y3(:,1);
z5=y3(:,2);
z6=y3(:,3);
y4=importdata('B01-FREK_P-RMS_P-DISP_LC_FILT-R_LOAD.txt');
x4=y4(:,1);
z7=y4(:,2);
z8=y4(:,3);
y5=importdata('B02-FREK_P-RMS_P-OUT_LC_FILT-R_LOAD.txt');
x5=y5(:,1);
z9=y5(:,2);
z10=y5(:,3);
y6=importdata('B02-FREK_P-RMS_P-DISP_LC_FILT-R_LOAD.txt');
x6=y6(:,1);
z11=y6(:,2);
z12=y6(:,3);
figure(1);
% Subplot
subplot(2,1,1);
semilogx(x1,z1,'k:',x2,z3,'r:',x3,z5,'k--',x4,z7,'r--',x5,z9,'k-
.',x6,z11,'r-.');
grid on; grid minor;
%title('RMS Value of Output and Dissipation Power of LC Filter');
legend('Pout [39]','Pdamp [39]','Pout Skenario Satu','Pdamp
Skenario Satu','Pout Skenario Dua','Pdamp Skenario Dua');
xlabel('Frequency (Hz)');
ylabel('Magnitude (Watt)');
subplot(2,1,2);
semilogx(x1,z2,'k:',x2,z4,'r:',x3,z6,'k--',x4,z8,'r--',x5,z10,'k-
.',x6,z12,'r-.');
grid on; grid minor;
%title('Value of Output and Dissipation Power of LC Filter');
legend('Pout [39]','Pdamp [39]','Pout Skenario Satu','Pdamp
Skenario Satu','Pout Skenario Dua','Pdamp Skenario Dua');
xlabel('Frequency (Hz)');
ylabel('Magnitude (Watt)');
```

Lampiran 14 *Netlist* Program PSpice Tanggapan Waktu dari Rangkaian Filter LC + Damper R_D + Beban R_L dengan Masukan Sinyal SPWM

```
MASUKAN SPWM DGN FILTER LC + DAMPER R + BEBAN R
.PARAM fout=50Hz ; frekuensi teg luaran
.PARAM P=11      ; jumlah pulsa per setengah perioda
.PARAM M=0.9     ; magnitudo teg carrier
*****************************************
E_MUL 1 0 VALUE {V(6)*V(5)}            ; Multiplier
V_MOD 2 0 AC 0 SIN (0 {M} {fout} 0 0 0); Modulating signal
frequency
E_ABS 3 0 VALUE {ABS(V(2))}            ; Nilai mutlak sinyal
carrier
V_REF 4 0 PULSE (1 0 0 {1/(2*{2*{p}*{fout}})}
{1/(2*{2*{p}*{fout}})-1ns} 1ns {1/{2*{p}*{fout}}}); sinyal gigi
gergaji (pemodulasi)
Vx    5 0 PULSE (-36 36 0 1ns 1ns {1/(2*{fout})-2ns} {1/{fout}});
E_ABM 6 0 VALUE {IF(V(3)-V(4)> 0,1,0)} ;
*************** Filter
L1  1  7  {LF1}
CF  7  8  {CFF}
*RD  8  0  {RD}
Vc  8  0  0V     ; sensor arus kapasitor
*************** Load
RL  7  0 {RL}
************* parameter-parameter **************
***Konfigurasi filter tanpa damper
*.PARAM LF1=550mH CFF=80uF RL=170
*.PARAM LF1=0.175mH CFF=85uF RL=33
*.PARAM LF1=20mH CFF=499uF RL=50
*.PARAM LF1=40mH CFF=249.5uF RL=100
***Konfigurasi filter tanpa damper (new value)
*.PARAM LF1=19.6mH CFF=392.16uF RL=50
.PARAM LF1=39.2mH CFF=196.08uF RL=100
***Konfigurasi filter dengan damper
*.PARAM LF1=80mH CFF=300uF RD=6 RL=50
*.PARAM LF1=20mH CFF=499uF RD=0.1002 RL=50
*.PARAM LF1=40mH CFF=249.5uF RD=0.2004 RL=100
*****************************************
.TRAN 1US 10S 9900ms 1us UIC; Transient Analysis
.FOUR 50Hz 100 V(7,0) I(RL) ; Fourier Analysis
.OP
************* Probe masukan SPWM **************
*.PROBE V(2,0) V(3,0) V(4,0) V(5,0) V(6,0) V(1,0)
******** Probe keluaran tanpa damper **********
.PROBE V(1,0) V(1,7) I(L1) V(7,8) I(Vc) V(7,0) I(RL) V(8,0)
******* Probe keluaran dengan damper **********
*.PROBE V(1,0) V(1,7) I(L1) V(7,8) V(8,0) I(RD) V(7,0) I(RL)
.END
```

Lampiran 15 Cuplikan Data Tanggapan Frekuensi Disipasi Daya RMS dan Rata-Rata

1.000000000000e+001	3.270961912833e+000	3.270961912833e+000
1.000023026116e+001	3.271050077051e+000	3.271050075795e+000
1.000046052762e+001	3.271138264944e+000	3.271138262431e+000
1.000069079939e+001	3.271226466841e+000	3.271226462233e+000
1.000092107645e+001	3.271314631784e+000	3.271314624248e+000
1.000115135882e+001	3.271402811569e+000	3.271402800264e+000
1.000138164649e+001	3.271491028891e+000	3.271491012975e+000
1.000161193947e+001	3.271579224728e+000	3.271579203369e+000
1.000184223775e+001	3.271667408318e+000	3.271667380680e+000
1.000207254133e+001	3.271755620089e+000	3.271755585329e+000
1.000230285021e+001	3.271843835399e+000	3.271843792679e+000
1.000253316439e+001	3.271932041763e+000	3.271931990248e+000
1.000276348388e+001	3.272020256480e+000	3.272020195332e+000
1.000299380868e+001	3.272108488825e+000	3.272108417201e+000
1.000322413877e+001	3.272196723456e+000	3.272196640518e+000
1.000345447417e+001	3.272284951976e+000	3.272284856891e+000
1.000368481488e+001	3.272373194865e+000	3.272373086790e+000
1.000391516088e+001	3.272461450144e+000	3.272461328236e+000
1.000414551219e+001	3.272549700177e+000	3.272549563603e+000
1.000437586881e+001	3.272637953056e+000	3.272637800977e+000
1.000460623073e+001	3.272726216884e+000	3.272726048459e+000
1.000483659795e+001	3.272814484425e+000	3.272814298815e+000
1.000506697048e+001	3.272902754002e+000	3.272902550370e+000
1.000529734831e+001	3.272991025872e+000	3.272990803381e+000
	.	
	.	
	.	
	.	
9.995395889931e+001	2.532397792864e+001	5.191267888850e+000
9.995626045077e+001	2.532365807770e+001	5.191123988312e+000
9.995856205522e+001	2.532333823129e+001	5.190980092564e+000
9.996086371266e+001	2.532301838940e+001	5.190836201605e+000
9.996316542311e+001	2.532269855205e+001	5.190692315433e+000
9.996546718656e+001	2.532237871922e+001	5.190548434051e+000
9.996776900300e+001	2.532205889091e+001	5.190404557459e+000
9.997007087245e+001	2.532173906713e+001	5.190260685655e+000
9.997237279490e+001	2.532141924788e+001	5.190116818640e+000
9.997467477036e+001	2.532109943315e+001	5.189972956412e+000
9.997697679882e+001	2.532077962295e+001	5.189829098972e+000
9.997927888028e+001	2.532045981728e+001	5.189685246319e+000
9.998158101476e+001	2.532014001613e+001	5.189541398454e+000
9.998388320225e+001	2.531982021950e+001	5.189397555376e+000
9.998618544274e+001	2.531950042741e+001	5.189253717083e+000
9.998848773625e+001	2.531918063984e+001	5.189109883577e+000
9.999079008277e+001	2.531886085679e+001	5.188966054858e+000
9.999309248230e+001	2.531854107827e+001	5.188822230927e+000
9.999539493485e+001	2.531822130427e+001	5.188678411781e+000
9.999769744042e+001	2.531790153480e+001	5.188534597422e+000
9.999999999900e+001	2.531758176986e+001	5.188390787850e+000

Lampiran 16 Cuplikan Data Daya Tanggapan Waktu Untuk Rangkaian Skenario Satu Dengan Damper

Time	I(L1)* V(1,0)	I(L1)*V(1,7)
I(RD)* V(7,8)	I(RD)* V(8,0)	I(RL)*V(7,0)
9.900000000020e+000	0.000000000000e+000	-2.880643845199e+002
-7.429754923717e+002	1.070951147984e+000	1.029968943086e+003
9.900000000118e+000	0.000000000000e+000	-2.880641410475e+002
-7.429757632871e+002	1.070951928218e+000	1.029968943086e+003
9.900000000314e+000	0.000000000000e+000	-2.880636270503e+002
-7.429761967516e+002	1.070953235054e+000	1.029968943086e+003
9.900000000706e+000	0.000000000000e+000	-2.880626261083e+002
-7.429772262300e+002	1.070956180463e+000	1.029968943086e+003
9.900000001020e+000	0.000000000000e+000	-2.880618145338e+002
-7.429780389760e+002	1.070958521173e+000	1.029968943086e+003
9.900000001098e+000	0.000000000000e+000	-2.880615787449e+002
-7.429782557083e+002	1.070959125877e+000	1.029968873832e+003
9.900000001255e+000	0.000000000000e+000	-2.880611729576e+002
-7.429786349898e+002	1.070960257182e+000	1.029968873832e+003
9.900000001569e+000	0.000000000000e+000	-2.880603884356e+002
-7.429793935528e+002	1.070962422363e+000	1.029968873832e+003
9.900000002196e+000	0.000000000000e+000	-2.880587652866e+002
-7.429809691594e+002	1.070967103799e+000	1.029968765622e+003
9.900000003450e+000	0.000000000000e+000	-2.880555266724e+002
-7.429841659603e+002	1.070976291168e+000	1.029968696368e+003
9.900000005959e+000	0.000000000000e+000	-2.880490417611e+002
	.	
	.	
	.	
-7.171002179929e+002	9.970760283545e-001	1.030672349843e+003
9.999990750058e+000	0.000000000000e+000	-3.119822543023e+002
-7.196265937952e+002	1.004169779208e+000	1.030604662013e+003
9.999991750081e+000	0.000000000000e+000	-3.093955203360e+002
-7.221525082767e+002	1.011288011617e+000	1.030536729618e+003
9.999992750104e+000	0.000000000000e+000	-3.068090230843e+002
-7.246780748837e+002	1.018431042064e+000	1.030468660921e+003
9.999993750126e+000	0.000000000000e+000	-3.042227569688e+002
-7.272031842144e+002	1.025598618734e+000	1.030400308737e+003
9.999994750149e+000	0.000000000000e+000	-3.016367225010e+002
-7.297279384414e+002	1.032790812111e+000	1.030331889553e+003
9.999995750172e+000	0.000000000000e+000	-2.990509000873e+002
-7.322522828761e+002	1.040007539819e+000	1.030263117662e+003
9.999996750195e+000	0.000000000000e+000	-2.964653106904e+002
-7.347761676944e+002	1.047248795643e+000	1.030194278805e+003
9.999997750218e+000	0.000000000000e+000	-2.938799621175e+002
-7.372997497638e+002	1.054514825053e+000	1.030125195509e+003
9.999998750241e+000	0.000000000000e+000	-2.912948283430e+002
-7.398228163542e+002	1.061805294125e+000	1.030055867801e+003
9.999999750264e+000	0.000000000000e+000	-2.887099492225e+002
-7.423455788570e+002	1.069120429948e+000	1.029986326005e+003
1.000000000000e+001	0.000000000000e+000	-2.880644386248e+002
-7.429754381886e+002	1.070950972451e+000	1.029968943086e+003

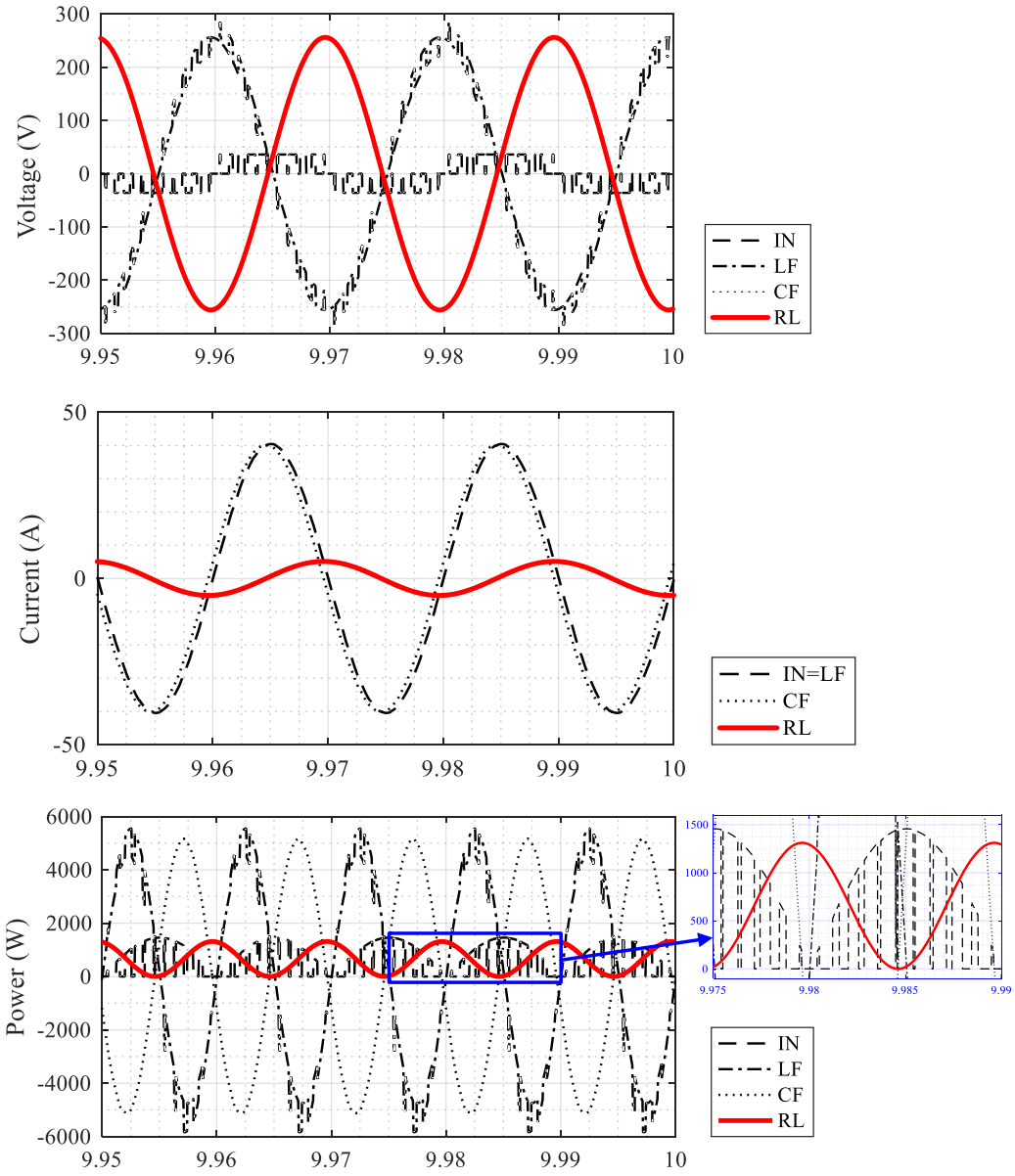
Lampiran 17 Cuplikan Data Arus Tanggapan Waktu Untuk Rangkaian Skenario Satu Dengan Damper

```
  Frequency              I(L1)                   I(RD)
I(RL)
  1.000000000000e+001  1.395209203101e+000  1.174593823494e+000
7.492718549393e-001
  1.000023026116e+001  1.395234714518e+000  1.174623067765e+000
7.492732989583e-001
  1.000046052762e+001  1.395260127433e+000  1.174652312037e+000
7.492746833446e-001
  1.000069079939e+001  1.395285639114e+000  1.174681556310e+000
7.492760677802e-001
  1.000092107645e+001  1.395311052291e+000  1.174710800693e+000
7.492775117512e-001
  1.000115135882e+001  1.395336597708e+000  1.174740044967e+000
7.492788961385e-001
  1.000138164649e+001  1.395362011146e+000  1.174769289242e+000
7.492802805751e-001
  1.000161193947e+001  1.395387523353e+000  1.174798533517e+000
7.492817245471e-001
  1.000184223775e+001  1.395413035692e+000  1.174827777793e+000
7.492831089844e-001
.
.
.
  9.997237279490e+001  3.828582470250e+000  3.813201845167e+000
2.434296437839e-001
  9.997467477036e+001  3.828435495112e+000  3.813055831443e+000
2.434147249250e-001
  9.997697679882e+001  3.828288520231e+000  3.812909820616e+000
2.433997912871e-001
  9.997927888028e+001  3.828141545368e+000  3.812763572512e+000
2.433848724324e-001
  9.998158101476e+001  3.827994570525e+000  3.812617561789e+000
2.433699535799e-001
  9.998388320225e+001  3.827847595700e+000  3.812471551116e+000
2.433550349654e-001
  9.998618544274e+001  3.827700621133e+000  3.812325540496e+000
2.433401161171e-001
  9.998848773625e+001  3.827553646585e+000  3.812179532773e+000
2.433251975069e-001
  9.999079008277e+001  3.827406672055e+000  3.812033522255e+000
2.433102788988e-001
  9.999309248230e+001  3.827259697544e+000  3.811887511789e+000
2.432953750740e-001
  9.999539493485e+001  3.827112961587e+000  3.811741504220e+000
2.432804564701e-001
  9.999769744042e+001  3.826965987114e+000  3.811595493857e+000
2.432655381044e-001
  9.999999999900e+001  3.826819012898e+000  3.811449723720e+000
2.432506342859e-001
```

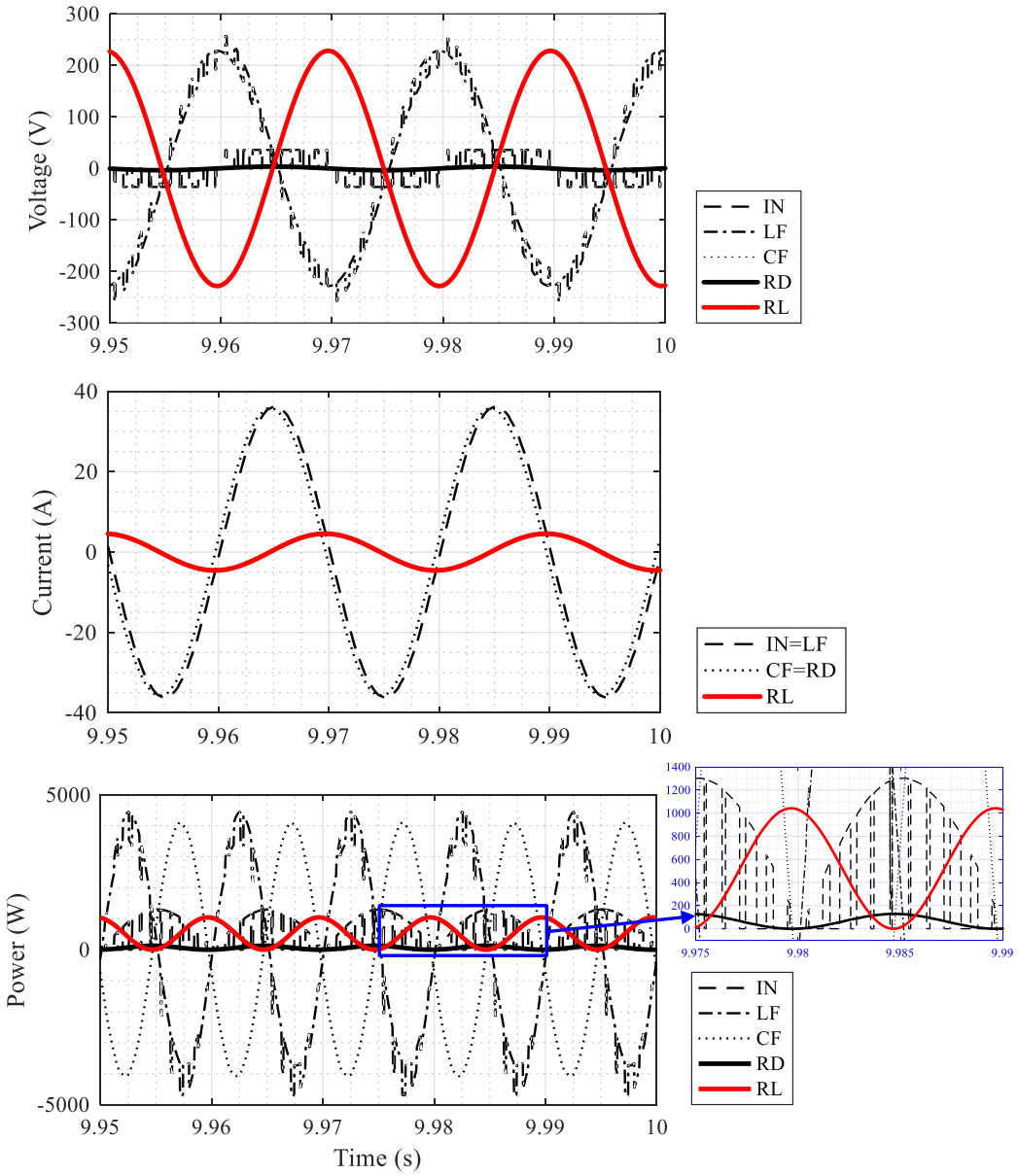
Lampiran 18 Cuplikan Data Komponen Fourier Tegangan Untuk Rangkaian Skenario Satu Tanpa Damper

```
FOURIER COMPONENTS OF TRANSIENT RESPONSE V(7,0)
 DC COMPONENT =   4.1116E-06
 HARMONIC   FREQUENCY     FOURIER     NORMALIZED     PHASE
NORMALIZED
    NO          (HZ)      COMPONENT     COMPONENT     (DEG)
PHASE (DEG)
     1    5.0000E+01   1.1957E+02   1.0000E+00  -2.7036E+01
0.0000E+00
     2    1.0000E+02   4.6028E-06   3.8495E-08   1.1608E+00
5.5233E+01
     3    1.5000E+02   2.3146E-03   1.9358E-05   1.1717E+02
1.9828E+02
     4    2.0000E+02   9.4510E-06   7.9043E-08  -1.3599E+02  -
2.7850E+01
     5    2.5000E+02   1.0295E-03   8.6105E-06  -4.4468E+01
9.0713E+01
     6    3.0000E+02   4.8074E-06   4.0206E-08   1.7916E+02
3.4138E+02
     7    3.5000E+02   4.4369E-04   3.7107E-06  -8.8820E+01
1.0043E+02
.
.
.
    88    4.4000E+03   1.6042E-05   1.3417E-07   5.4672E+01
2.4339E+03
    89    4.4500E+03   2.2087E-04   1.8472E-06   3.1985E+00
2.4094E+03
    90    4.5000E+03   3.1702E-06   2.6514E-08   1.6852E+01
2.4501E+03
    91    4.5500E+03   2.2499E-04   1.8817E-06  -1.7758E+02
2.2827E+03
    92    4.6000E+03   1.3264E-05   1.1093E-07   7.3438E+00
2.4947E+03
    93    4.6500E+03   1.3505E-04   1.1294E-06  -4.7157E+00
2.5097E+03
    94    4.7000E+03   1.2403E-05   1.0373E-07  -4.9420E+01
2.4920E+03
    95    4.7500E+03   4.7655E-05   3.9856E-07   1.7661E+02
2.7451E+03
    96    4.8000E+03   5.3122E-06   4.4428E-08  -1.5201E+02
2.4435E+03
    97    4.8500E+03   4.1565E-04   3.4763E-06  -1.7756E+02
2.4450E+03
    98    4.9000E+03   1.4449E-05   1.2084E-07  -1.1866E+02
2.5309E+03
    99    4.9500E+03   3.3764E-04   2.8238E-06  -1.7959E+02
2.4970E+03
   100    5.0000E+03   5.8913E-05   4.9271E-07  -1.7630E+02
2.5273E+03
     TOTAL HARMONIC DISTORTION =   3.8091E-02 PERCENT
```

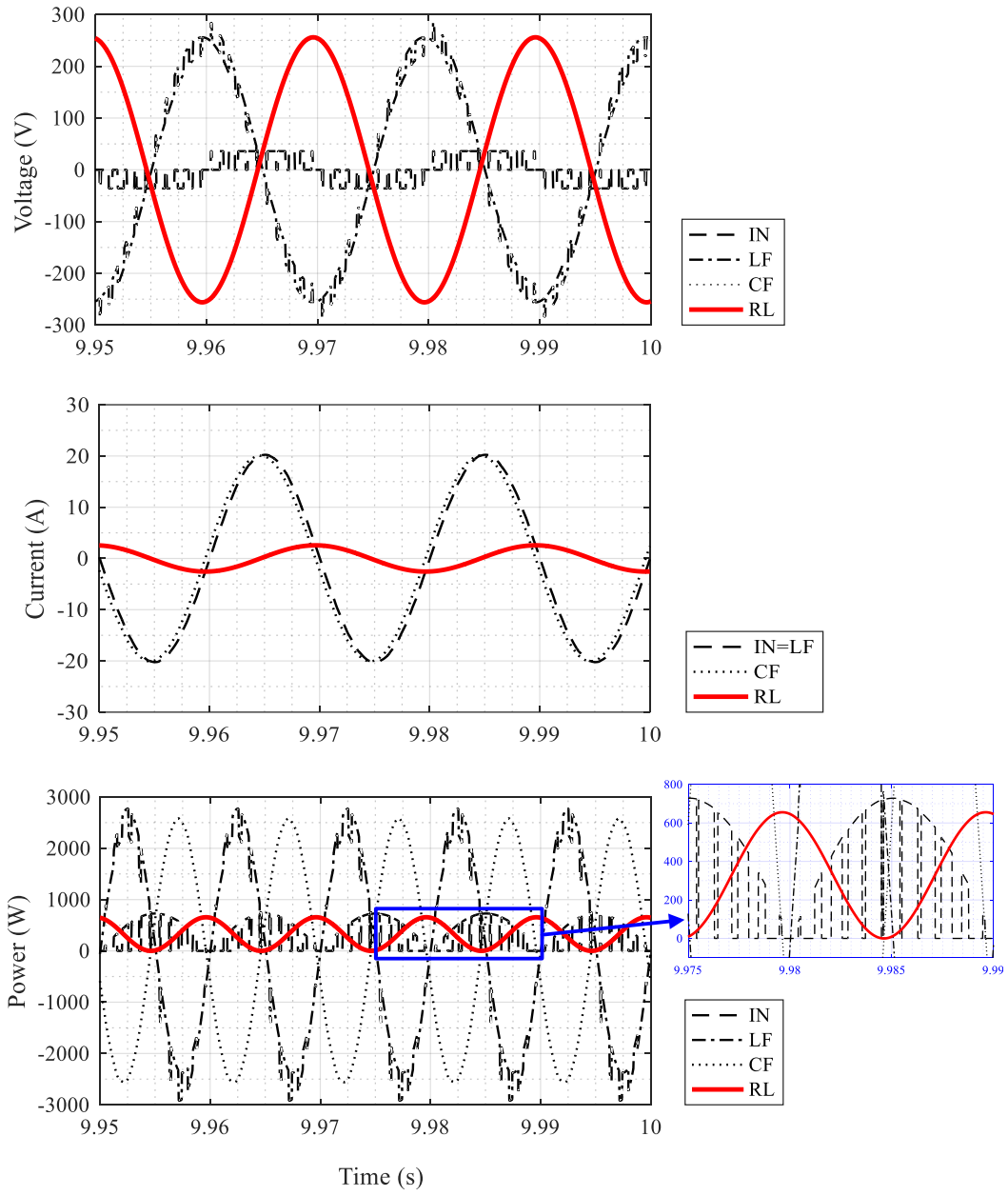
Lampiran 19 Simulasi Tanggapan Waktu Skenario Satu (Kondisi Tanpa Damper) Untuk Parameter Tegangan, Arus, dan Daya



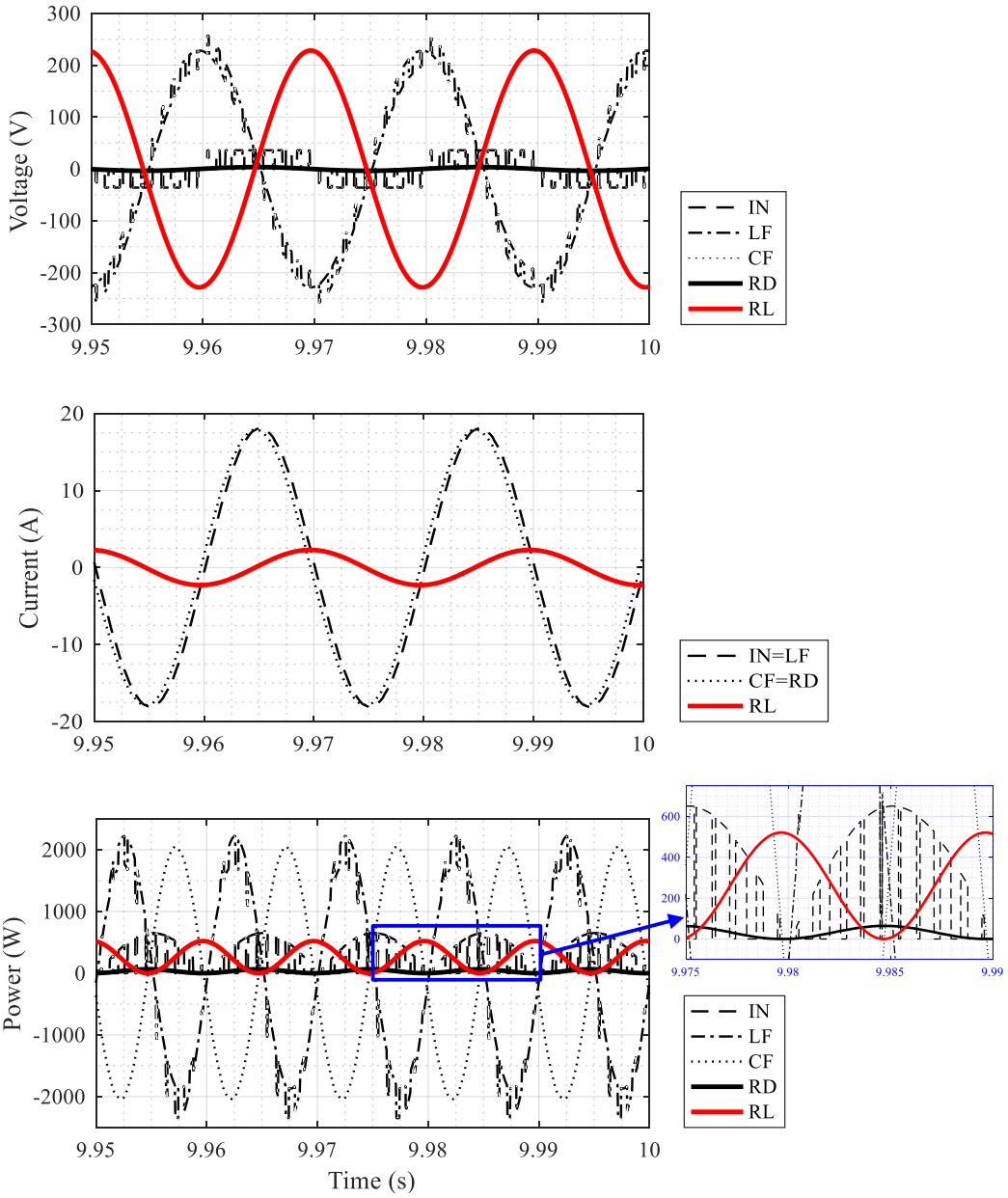
Lampiran 20 Simulasi Tanggapan Waktu Skenario Satu (Kondisi Dengan Damper) Untuk Parameter Tegangan, Arus, dan Daya



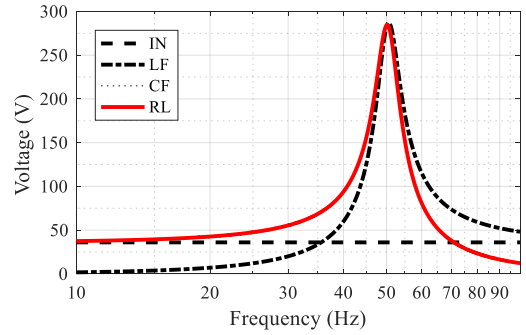
Lampiran 21 Simulasi Tanggapan Waktu Skenario Dua (Kondisi Tanpa Damper) Untuk Parameter Tegangan, Arus, dan Daya



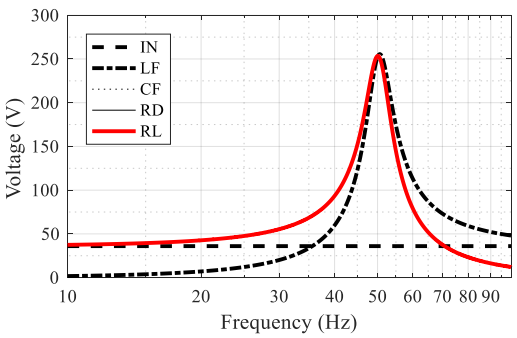
Lampiran 22 Simulasi Tanggapan Waktu Skenario Dua (Kondisi Dengan Damper) Untuk Parameter Tegangan, Arus, dan Daya



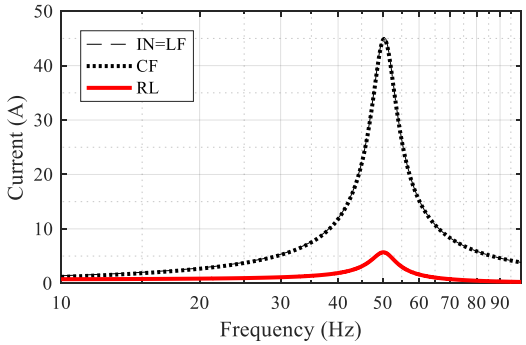
Lampiran 23 Simulasi Tanggapan Frekuensi Skenario Satu untuk Parameter Tegangan, Arus, dan Daya



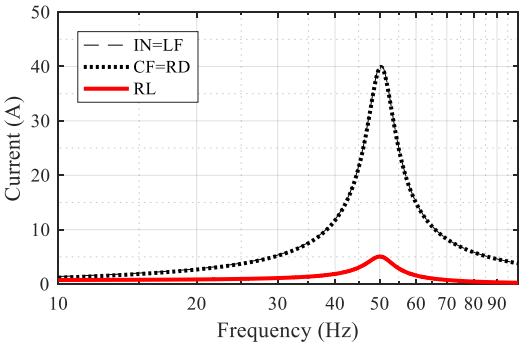
(a) Kondisi Tanpa Damper



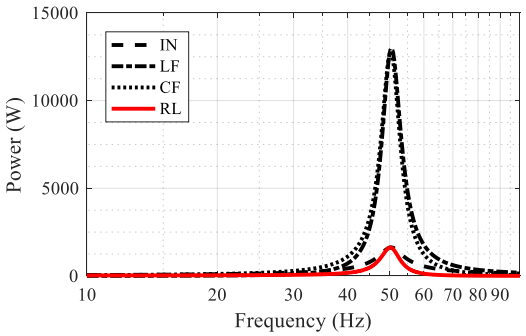
(b) Kondisi Dengan Damper



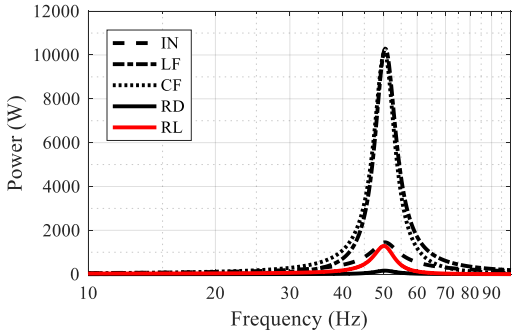
(a) Kondisi Tanpa Damper



(b) Kondisi Dengan Damper

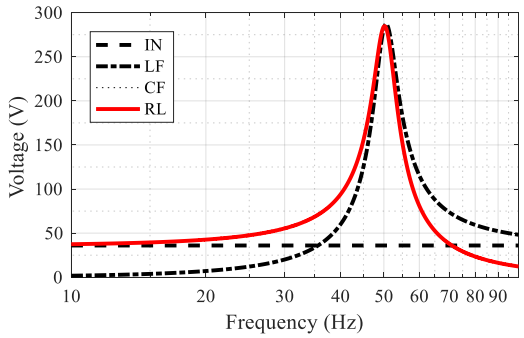


(a) Kondisi Tanpa Damper

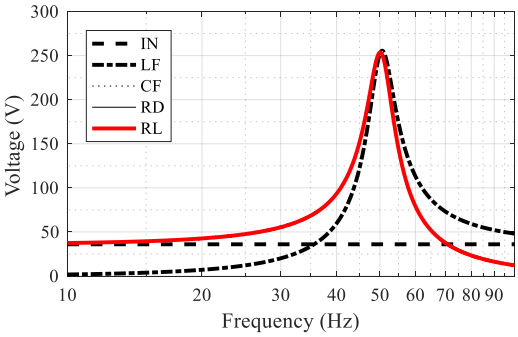


(b) Kondisi Dengan Damper

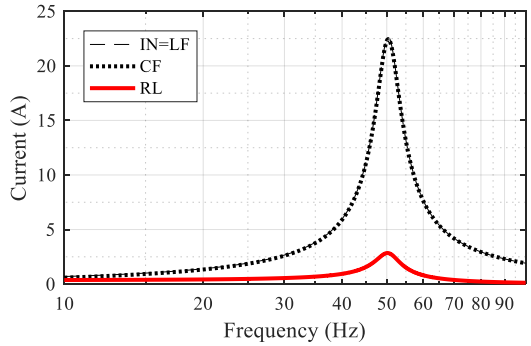
Lampiran 24 Simulasi Tanggapan Frekuensi Skenario Dua untuk Parameter Tegangan, Arus, dan Daya



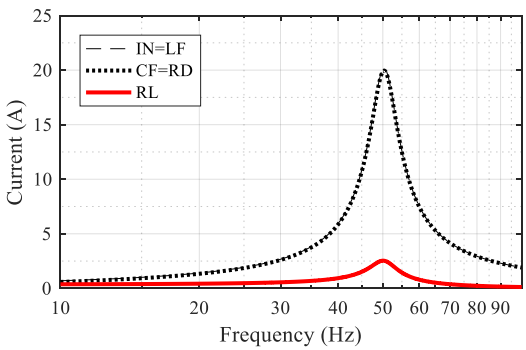
(a) Kondisi Tanpa Damper



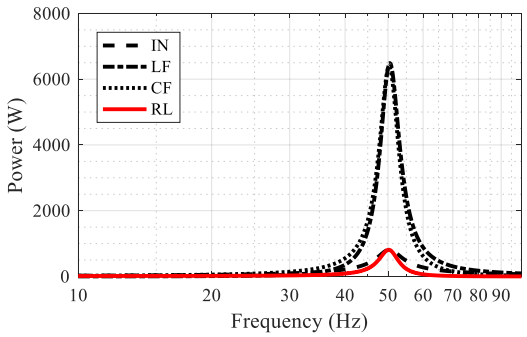
(b) Kondisi Dengan Damper



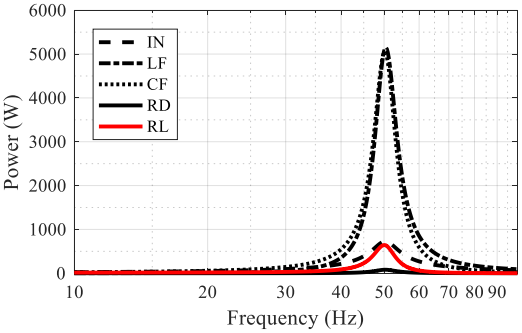
(a) Kondisi Tanpa Damper



(b) Kondisi Dengan Damper



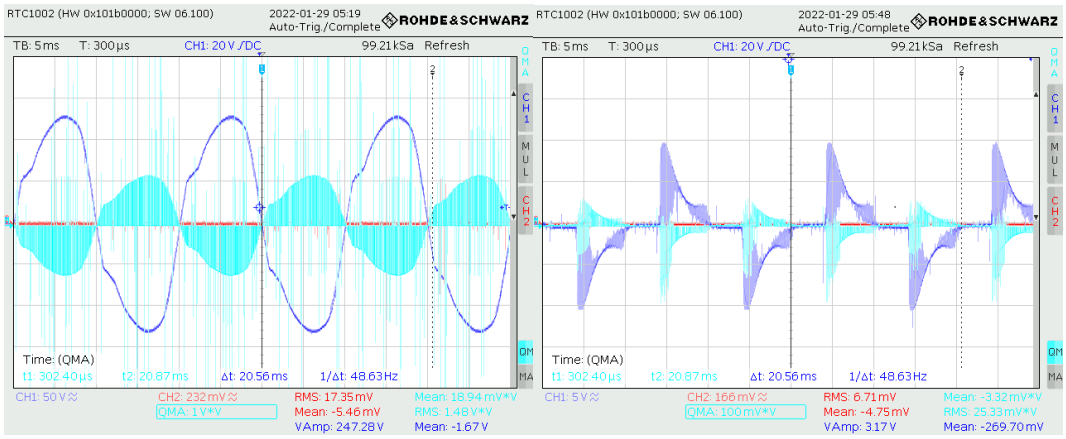
(a) Kondisi Tanpa Damper



(b) Kondisi Dengan Damper

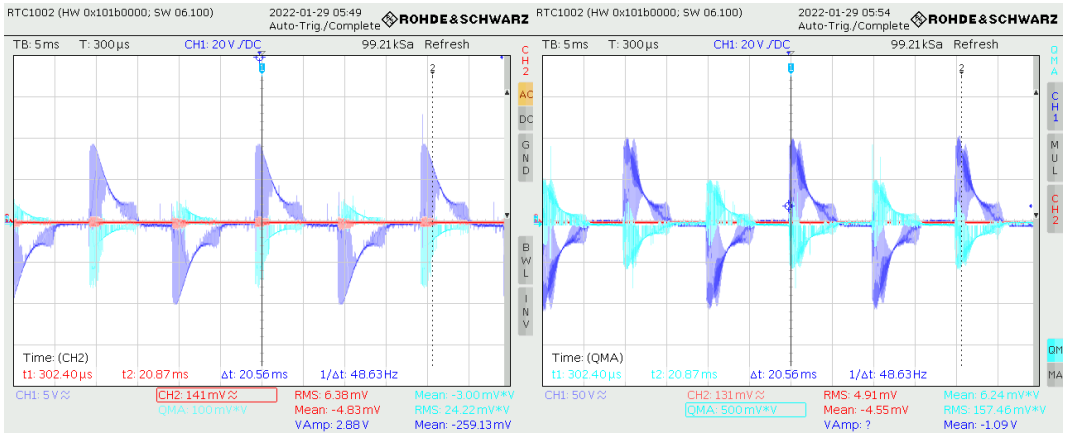
Lampiran 25 Percobaan Pengujian Rangkaian pada Skenario Satu Dengan Damper

Daya pada Damper:

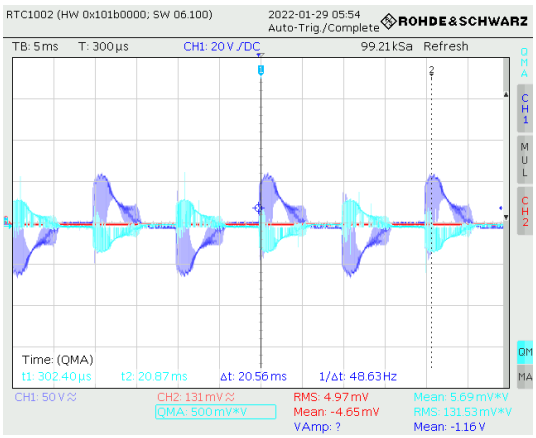


Beban OFF Beban ON

Daya pada Keluaran:



Beban OFF Beban ON



Daya Luaran Tanpa Damper