LAMPIRAN

Lampiran 1: *Script* Matlab Pengambilan Data Akusisi.

```
%Script acquisition Matlab R2017a using National Instrument NI9234
%Created: July 2018, Niko Prastomo
clear all;
clc;
close all;
tic;


s = daq.createSession('ni');
s.DurationInSeconds = 10;
Dur = s.DurationInSeconds;
s.Rate = 17066;
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0', 'Accelerometer');
s.Channels(1).Sensitivity = 100.10E-3; %mV/g Type 4507B
serial:11165


for i=1:50
data = s.startForeground();   % start recording vibration data
data_ch1 = data(:,1);
rootname = 'E:\Tugas_Akhir';      % drive tujuan dan nama file
extension = '.mat';               % ekstension utk nama file
namafile = [rootname,'Normal_',num2str(i),extension];
data_all = [data_ch1];
eval(['save ', namafile ,' data_all']);
```

Lampiran 2: *Script* Matlab Plot Data Domain Waktu

```
%Direktori tempat data mentah getaran berada
load('D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai\1.
Domain Waktu\1. Training Data\1. Normal\Tugas_AkhirNormal1_200')
y1=data_all(:,1);
load('D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai\1.
Domain Waktu\1. Training Data\2. Kavitasi Level
1\Tugas_AkhirKavitasiLevel1_200')
y2=data_all(:,1);
```

```
load('D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai\1.
Domain Waktu\1. Training Data\3. Kavitasi Level
2\Tugas_AkhirKavitasiLevel2_200')
y3=data_all(:,1);
load('D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai\1.
Domain Waktu\1. Training Data\4. Kavitasi Level
3\Tugas_AkhirKavitasiLevel3_200')
y4=data_all(:,1);

%% plot amplitude time domain
figure
subplot(9,1,1)
plot(y1(1:170660))
axis([0 9000 -3 3])
legend('Normal')

subplot(9,1,2)
plot(y2(1:170660),'b')
axis([0 9000 -3 3])
legend('Kavitasi1')

subplot(9,1,3)
plot(y3(1:170660),'g')
axis([0 9000 -3 3])
legend('Kavitasi2')

subplot(9,1,4)
plot(y4(1:170660),'b')
axis([0 9000 -3 3])
legend('Kavitasi3')

xlabel('Sampel')
ylabel('Amplitudo')
```

Lampiran 3: *Script* Matlab Ekstraksi Parameter Statistik Domain Waktu

```
clc
close all
clear

%Normal
for d=(401:500)
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\1. Normal\Tugas_AkhirNormal1_',int2str(d),'.mat'];
load (signal_in)

a=data_all(:,1);
R(d)=rms(a);
S(d)=std(a);
P(d)=((max(abs(a))-min(abs(a)))/2);
K(d)=kurtosis(a);
V(d)=var(a);
C(d)=peak2rms(a);
M(d)=mean(a);
x=1:100;

Normaltrai=zeros(100,7);
R=R';                          %Transpose RMS
S=S';                          %Transpose Standar Deviation
P=P';                          %Transpose Peak Value
K=K';                          %Transpose Kurtosis
V=V';                          %Transpose Variance
C=C';                          %Transpose Crest Factor
M=M';                          %Transpose Mean
end

%Kavitasi1
for di=(401:500)
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\2. Kavitasi Level
1\Tugas_AkhirKavitasiLevel1_',int2str(di),'.mat'];
load (signal_in)
```

```
b=data_all(:,1);
R1(di)=rms(b);
S1(di)=std(b);
P1(di)=((max(abs(b))-min(abs(b)))/2);
K1(di)=kurtosis(b);
V1(di)=var(b);
C1(di)=peak2rms(b);
M1(di)=mean(b);
x1=1:100;

Kavitasi1trai=zeros(100,7);
R1=R1';                          %Transpose RMS
S1=S1';                          %Transpose Standar Deviation
P1=P1';                          %Transpose Peak Value
K1=K1';                          %Transpose Kurtosis
V1=V1';                          %Transpose Variance
C1=C1';                          %Transpose Crest Factor
M1=M1';                          %Transpose Mean
end

%kavitasi2
for dii=(401:500)
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\3. Kavitasi Level
2\Tugas_AkhirKavitasiLevel2_',int2str(dii),'.mat'];
load (signal_in)

f=data_all(:,1);
R2(dii)=rms(f);
S2(dii)=std(f)
P2(dii)=((max(abs(f))-min(abs(f)))/2);
K2(dii)=kurtosis(f);
V2(dii)=var(f);
C2(dii)=peak2rms(f);
M2(dii)=mean(f);
x2=1:100;
```

```
Kavitasi2trai=zeros(100,7);
R2=R2';                                 %Transpose RMS
S2=S2';                                 %Transpose Standar Deviation
P2=P2';                                 %Transpose Peak Value
K2=K2';                                 %Transpose Kurtosis
V2=V2';                                 %Transpose Variance
C2=C2';                                 %Transpose Crest Factor
M2=M2';                                 %Transpose Mean
end

%kavitasi3
for diii=(401:500)
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\4. Kavitasi Level
3\Tugas_AkhirKavitasiLevel3_',int2str(diii),'.mat'];
load (signal_in)

e=data_all(:,1);
R3(diii)=rms(e);
S3(diii)=std(e);
P3(diii)=((max(abs(e))-min(abs(e)))/2);
K3(diii)=kurtosis(e);
V3(diii)=var(e);
C3(diii)=peak2rms(e);
M3(diii)=mean(e);
x3=1:100;

Kavitasi3trai=zeros(100,7);
R3=R3';                                 %Transpose RMS
S3=S3';                                 %Transpose Standar Deviation
P3=P3';                                 %Transpose Peak Value
K3=K3';                                 %Transpose Kurtosis
V3=V3';                                 %Transpose Variance
C3=C3';                                 %Transpose Crest Factor
M3=M3';                                 %Transpose Mean
end
```

Lampiran 4: *Script* Matlab Plot Garfik Ekstraksi Parameter Statistik Domain Waktu

```
%RMS
figure
s=14;
c='r';
scatter(x,(R),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(R1),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(R2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(R3),s,c,'+');

axis([0 500 0 1.5])
title('Grafik RMS')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Standard deviation
figure
s=14;
c='r';
scatter(x,(S),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(S1),s,c,'x');
hold on
s=14;
c='g';
```

```
scatter(x2,(S2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(S3),s,c,'+');

axis([0 100 0 1.5])
title('Grafik Standar Deviasi')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Peak value
figure
s=14;
c='r';
scatter(x,(P),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(P1),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(P2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(P3),s,c,'+');

axis([0 100 0 3.5])
title('Grafik Peak Value')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Kurtosis
figure
s=14;
```

```
c='r';
scatter(x,(K),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(K1),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(K2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(K3),s,c,'+');

axis([0 500 2.5 4])
title('Grafik Kurtosis')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Variance
figure
s=14;
c='r';
scatter(x,(V),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(V1),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(V2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(V3),s,c,'+');
```

```
axis([0 100 0 2])
title('Grafik Varians')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Crest factor
figure
s=14;
c='r';
scatter(x,(C),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(C1),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(C2),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(C3),s,c,'+');

axis([0 100 4 6])
title('Grafik Crest Factor')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Mean
figure
s=9;
c='r';
scatter(x,(M),s,c,'v');
hold on
s=9;
c='b';
```

```
scatter(x1,(M1),s,c,'x');
hold on
s=9;
c='g';
scatter(x2,(M2),s,c,'o');
hold on
s=9;
c='c';
scatter(x3,(M3),s,c,'+');

axis([0 100 -0.01 0.01])
title('Grafik Mean')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
```

Lampiran 5: *Script* Matlab *Principal Component Analysis* (PCA) Domain Waktu

```
vector_ch1234(:,:,1)=Normaltraining;
vector_ch1234(:,:,2)=KavitasiTraining1;
vector_ch1234(:,:,3)=KavitasiTraining2;
vector_ch1234(:,:,4)=KavitasiTraining3;
for i=1:4

eval (
['[LOADING_ch',int2str(i),',SCORE_ch',int2str(i),',latent_ch',int2
str(i),',T2_ch',int2str(i),']
=princomp(zscore(vector_ch1234(:,:,',int2str(i),')));']);
eval ( [
'[norm_vector_ch1234(:,:,',int2str(i),'),MU(i,:),SIGMA(i,:)]=
zscore(vector_ch1234(:,:,',int2str(i),'));' ])
eval ( ['loading(:,:,',int2str(i),')=LOADING_ch',int2str(i),';'])
eval ( ['score(:,:,',int2str(i),')=SCORE_ch',int2str(i),';'])
eval ( ['latent(:,',int2str(i),')=latent_ch',int2str(i),';'])
end

%% Plot pareto
 figure()
pareto(latent)
```

```
xlabel('Principal Component')
ylabel('Variance Explained (%)')

% Training x Testing
PCANormal=TestingNormal*LOADING_ch1
PCAKavitasi1=TestingKavitasi1*LOADING_ch2
PCAKavitasi2=TestingKavitasi2*LOADING_ch3
PCAKavitasi3=TestingKavitasi3*LOADING_ch4

% Plot PCA
figure()
scatter3(PCANormal(:,1),PCANormal(:,2),PCANormal(:,3),'+')
hold on
scatter3(PCAKavitasi1(:,1),PCAKavitasi1(:,2),PCAKavitasi1(:,3),'x'
)
scatter3(PCAKavitasi2(:,1),PCAKavitasi2(:,2),PCAKavitasi2(:,3),'v'
)
scatter3(PCAKavitasi3(:,1),PCAKavitasi3(:,2),PCAKavitasi3(:,3),'o'
)

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
zlabel('3nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

figure()
plot(PCANormal(:,1),PCANormal(:,2),'+')
hold on
plot(PCAKavitasi1(:,1),PCAKavitasi1(:,2),'x')
plot(PCAKavitasi2(:,1),PCAKavitasi2(:,2),'v')
plot(PCAKavitasi3(:,1),PCAKavitasi3(:,2),'o')

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
```

Lampiran 6: *Script* Matlab *Fast Fourier Transform* (FFT)

```
%Konversi sinyal getaran domain waktu menjadi spektrum dengan FFT
%Created: Juli 2018, Niko Prastomo (20140130284)
clear
clc
close all

%% Normal
for d=(1:400);          %jumlah perulangan
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\1. Training\1. Normal\Tugas_AkhirNormal1_',int2str(d),'.mat'];
load(signal_in)

a=data_all(:,1);
sampling_rate=17066; %kecepatan sampling Hz
recording_time=100;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y = fft(a,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
S(:,d) = 2*abs(Y(1:NFFT/2+1));
end

%% Kavitasi 1
for di=(1:400);          %jumlah perulangan
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\1. Training\2. Kavitasi Level
1\Tugas_AkhirKavitasiLevel1_',int2str(di),'.mat'];
load(signal_in)

y=data_all(:,1);
sampling_rate=17066; %kecepatan sampling Hz
recording_time=100;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)
```

```
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y = fft(y,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
S1(:,di)= 2*abs(Y(1:NFFT/2+1));
end

%% Kavitasi 2
for dii=(1:400);          %jumlah perulangan

signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\1. Training\3. Kavitasi Level
2\Tugas_AkhirKavitasiLevel2_',int2str(dii),'.mat'];
load(signal_in)

b=data_all(:,1);
sampling_rate=17066; %kecepatan sampling Hz
recording_time=100;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y = fft(b,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
S2(:,dii)= 2*abs(Y(1:NFFT/2+1));
end

%% Kavitasi 3
for diii=(1:400);          %jumlah perulangan
signal_in=['D:\Data TA dan MATLAB\Data Tugas Akhir\2. Data Pakai
500\1. Training\4. Kavitasi Level
3\Tugas_AkhirKavitasiLevel3_',int2str(diii),'.mat'];
load(signal_in)

c=data_all(:,1);
sampling_rate=17066; %kecepatan sampling Hz
recording_time=100;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)
```

```
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y = fft(c,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
S3(:,diii)= 2*abs(Y(1:NFFT/2+1));
End
```

Lampiran 7: *Script* Matlab Plot Domain Frekuensi

```
% Plot single-sided amplitude spectrum
figure
subplot(4,1,1)
plot(f,S,'b')
axis([0 5000 0 0.2])
legend('Normal')

subplot(4,1,2)
plot(f,S1,'r')
axis([0 5000 0 0.2])
legend('Kavitasi1')

subplot(4,1,3)
plot(f,S2,'g')
axis([0 5000 0 0.2])
legend('Kavitasi2')

subplot(4,1,4)
plot(f,S3,'b')
axis([0 5000 0 0.2])
legend('Kavitasi3'
xlabel('Frequency (Hz)')
```

Lampiran 8: *Script* Matlab Ekstraksi Parameter Statistik Domain Frekuensi

```
%Ekstraksi Parameter Statistik Domain Frekuensi

%% Normal
```

```
for d=(1:400)
a=S(:,d);

MNF(d)= meanfreq(a);
MDF(d)= medfreq(a);
RMSF(d)= sqrt(sum((abs(a)/length(a)).^2));
SNR(d)= snr(a);
SND(d)= sinad(a);

%% Proses Transpose
MNF=MNF'
MDF=MDF'
RMSF=RMSF'
SNR=SNR'
SND=SND'
end

%% Kavitasi1
for di=(1:400)
ai=S1(:,di);

MNFi(di)= meanfreq(ai);
MDFi(di)= medfreq(ai);
RMSFi(di)= sqrt(sum((abs(ai)/length(ai)).^2));
SNRi(di)= snr(ai);
SNDi(di)= sinad(ai);

%% Proses Transpose
MNFi=MNFi'
MDFi=MDFi'
RMSFi=RMSFi'
SNRi=SNRi'
SNDi=SNDi'
end

%% Kavitasi2
for dii=(1:400)
```

```
aii=S2(:,dii);

MNFii(dii)= meanfreq(aii);
MDFii(dii)= medfreq(aii);
RMSFii(dii)= sqrt(sum((abs(aii)/length(aii)).^2));
SNRii(dii)= snr(aii);
SNDii(dii)= sinad(aii);

%% Proses Transpose
MNFii=MNFii'
MDFii=MDFii'
RMSFii=RMSFii'
SNRii=SNRii'
SNDii=SNDii'
end
%% Kavitasi3
for diii=(1:400)
aiii=S3(:,diii);

MNFiii(diii)= meanfreq(aiii);
MDFiii(diii)= medfreq(aiii);
RMSFiii(diii)= sqrt(sum((abs(aiii)/length(aiii)).^2));
SNRiii(diii)= snr(aiii);
SNDiii(diii)= sinad(aiii);

%% Proses Transpose
MNFiii=MNFiii'
MDFiii=MDFiii'
RMSFiii=RMSFiii'
SNRiii=SNRiii'
SNDiii=SNDiii'
End
```

Lampiran 9: *Script* Matlab Plot Ekstraksi Parameter Statistik Domain Frekuensi

```
%Plot Parameter Spektrum
%Mean Frequency
```

```
figure
s=14;
c='r';
scatter(x,(MNF),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(MNFi),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(MNFii),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(MNFiii),s,c,'+');

title('Grafik Mean Frequency')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%Median Frequency
figure
s=14;
c='r';
scatter(x,(MDF),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(MDFi),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(MDFii),s,c,'o');
hold on
s=14;
c='c';
```

```
scatter(x3,(MDFiii),s,c,'+');

title('Grafik Median Frequency')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%RMS Frequency
figure
s=14;
c='r';
scatter(x,(RMSF),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(RMSFi),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(RMSFii),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(RMSFiii),s,c,'+');

title('Grafik RMS Frequency')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%SNR
figure
s=14;
c='r';
scatter(x,(SNR),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(SNRi),s,c,'x');
```

```
hold on
s=14;
c='g';
scatter(x2,(SNRii),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(SNRiii),s,c,'+');

title('Grafik Signal to Ratio')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

%SINAD
figure
s=14;
c='r';
scatter(x,(SND),s,c,'v');
hold on
s=14;
c='b';
scatter(x1,(SNDi),s,c,'x');
hold on
s=14;
c='g';
scatter(x2,(SNDii),s,c,'o');
hold on
s=14;
c='c';
scatter(x3,(SNDiii),s,c,'+');

title('Grafik Signal to Ratio & Distortion')
xlabel('Sampel'),ylabel('Amplitudo')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
```

Lampiran 10: *Script* Matlab *Principal Component Analysis* (PCA) Domain Frekuensi

```
vector_ch1234(:,:,1)=Normaltraining;
vector_ch1234(:,:,2)=KavitasiTraining1;
vector_ch1234(:,:,3)=KavitasiTraining2;
vector_ch1234(:,:,4)=KavitasiTraining3;
for i=1:4

eval (
['[LOADING_ch',int2str(i),',SCORE_ch',int2str(i),',latent_ch',int2
str(i),',T2_ch',int2str(i),']
=princomp(zscore(vector_ch1234(:,:,',int2str(i),')));']);
eval ( [
'[norm_vector_ch1234(:,:,',int2str(i),'),MU(i,:),SIGMA(i,:)]=
zscore(vector_ch1234(:,:,',int2str(i),'));' ])
eval ( ['loading(:,:,',int2str(i),')=LOADING_ch',int2str(i),';'])
eval ( ['score(:,:,',int2str(i),')=SCORE_ch',int2str(i),';'])
eval ( ['latent(:,',int2str(i),')=latent_ch',int2str(i),';'])
end

%% Plot pareto
 figure()
pareto(latent)
xlabel('Principal Component')
ylabel('Variance Explained (%)')

% Training x Testing
PCANormal=TestingNormal*LOADING_ch1
PCAKavitasi1=TestingKavitasi1*LOADING_ch2
PCAKavitasi2=TestingKavitasi2*LOADING_ch3
PCAKavitasi3=TestingKavitasi3*LOADING_ch4

% Plot PCA
figure()
scatter3(PCANormal(:,1),PCANormal(:,2),PCANormal(:,3),'+')
hold on
scatter3(PCAKavitasi1(:,1),PCAKavitasi1(:,2),PCAKavitasi1(:,3),'x'
)
```

```
scatter3(PCAKavitasi2(:,1),PCAKavitasi2(:,2),PCAKavitasi2(:,3),'v'
)
scatter3(PCAKavitasi3(:,1),PCAKavitasi3(:,2),PCAKavitasi3(:,3),'o'
)

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
zlabel('3nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')

figure()
plot(PCANormal(:,1),PCANormal(:,2),'+')
hold on
plot(PCAKavitasi1(:,1),PCAKavitasi1(:,2),'x')
plot(PCAKavitasi2(:,1),PCAKavitasi2(:,2),'v')
plot(PCAKavitasi3(:,1),PCAKavitasi3(:,2),'o')

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
```

Lampiran 11: *Script* Matlab PCA Domain Waktu & Frekuensi

```
vector_ch1234(:,:,1)=GabunganTrainingNormal
vector_ch1234(:,:,2)=GabunganTrainingKavitasi1
vector_ch1234(:,:,3)=GabunganTrainingKavitasi2
vector_ch1234(:,:,4)=GabunganTrainingKavitasi3

for i=1:4
eval (
['[LOADING_ch',int2str(i),',SCORE_ch',int2str(i),',latent_ch',int2
str(i),',T2_ch',int2str(i),']
=princomp(zscore(vector_ch1234(:,:,',int2str(i),')));']);
eval ( [
'[norm_vector_ch1234(:,:,',int2str(i),'),MU(i,:),SIGMA(i,:)]=
zscore(vector_ch1234(:,:,',int2str(i),'));' ])
eval ( ['loading(:,:,',int2str(i),')=LOADING_ch',int2str(i),';'])
```

```
eval ( ['score(:,:,',int2str(i),')=SCORE_ch',int2str(i),';'])
eval ( ['latent(:,',int2str(i),')=latent_ch',int2str(i),';'])
end

% Training x Testing
PCANormal=GabunganTestingNormal*LOADING_ch1
PCAKavitasi1=GabunganTestingKavitasi1*LOADING_ch2
PCAKavitasi2=GabunganTestingKavitasi2*LOADING_ch3
PCAKavitasi3=GabunganTestingKavitasi3*LOADING_ch4

% Plot PCA
figure()
scatter3(PCANormal(:,1),PCANormal(:,2),PCANormal(:,3),'+')
hold on
scatter3(PCAKavitasi1(:,1),PCAKavitasi1(:,2),PCAKavitasi1(:,3),'x'
)
scatter3(PCAKavitasi2(:,1),PCAKavitasi2(:,2),PCAKavitasi2(:,3),'v'
)
scatter3(PCAKavitasi3(:,1),PCAKavitasi3(:,2),PCAKavitasi3(:,3),'o'
)

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
zlabel('3nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
figure()

plot(PCANormal(:,1),PCANormal(:,2),'+')
hold on
plot(PCAKavitasi1(:,1),PCAKavitasi1(:,2),'x')
plot(PCAKavitasi2(:,1),PCAKavitasi2(:,2),'v')
plot(PCAKavitasi3(:,1),PCAKavitasi3(:,2),'o')

xlabel('1st Principal Component')
ylabel('2nd Principal Component')
legend ('Normal','Kavitasi1','Kavitasi2','Kavitasi3')
```