LAMPIRAN

1. Plot Sinyal Getaran Pada Kondisi Normal

a. Domain Waktu

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2000\normal10.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2400\normal10.mat')
y4=data_all(:,1);

% plot amplitude time domain
figure
subplot(3,2,1)
plot(y1(1:52066))
title('(a)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,2)
plot(y2(1:52066))
title('(b)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,3)
plot(y3(1:52066))
title('(c)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,4)
plot(y4(1:52066))
title('(d)')
ylabel('Amplitudo')
xlabel('Sampel')
```

b. Spektrum Frekuensi

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal13.mat')
```

```
y1=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2000\normal2.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2400\normal10.mat')
y4=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %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
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y3 = fft(y3,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y4 = fft(y4,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,3)
plot(f,2*abs(Y3(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,4)
plot(f,2*abs(Y4(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

c. Spektrum Envelope

```
clear
clc
close

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_1200\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n1=sig_f/(norm(sig_f));
freq_s1=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_1600\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n2=sig_f/(norm(sig_f));
freq_s2=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_2000\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_2400\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

%envelope analysis based on Hilbert transform
figure
subplot(2,2,1);
plot(freq_s1,sig_n1);
axis ([0 2000 0 0.04]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,2);
plot(freq_s2,sig_n2);
```

```
axis ([0 2000 0 0.042]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2000 0 0.04]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s4,sig_n4);
axis ([0 2000 0 0.04]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

2. Plot Sinyal Getaran Pada Kondisi Bantalan Cacat Pada Lintasan Luar

a. <u>Domain Waktu</u>

```
clear
clc
close

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\outer10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\outer10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\outer10.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\outer10.mat')
y4=data_all(:,1);

% plot amplitude time domain
figure
subplot(3,2,1)
plot(y1(1:52066))
title('(a)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,2)
plot(y2(1:52066))
title('(b)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,3)
plot(y3(1:52066))
title('(c)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,4)
plot(y4(1:52066))
title('(d)')
ylabel('Amplitudo')
```

```
xlabel('Sampel')
```

b. Spektrum Frekuensi

```
clear
clc
close

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\outer3.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1600\outer10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\outer10.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\outer10.mat')
y4=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %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
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y3 = fft(y3,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y4 = fft(y4,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,3)
plot(f,2*abs(Y3(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,4)
plot(f,2*abs(Y4(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
```

```
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

c. Spektrum Envelope

```
clear
clc
close

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\outer3.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n1=sig_f/(norm(sig_f));
freq_s1=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1600\outer10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n2=sig_f/(norm(sig_f));
freq_s2=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\outer10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\outer10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

%envelope analysis based on Hilbert transform
figure
subplot(2,2,1);
plot(freq_s1,sig_n1);
axis ([0 2000 0 0.04]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,2);
plot(freq_s2,sig_n2);
```

```
axis ([0 2000 0 0.042]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2000 0 0.04]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s4,sig_n4);
axis ([0 2000 0 0.04]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

3. Plot Sinyal Getaran Pada Kondisi Bantalan Cacat Pada Lintasan Dalam

a. <u>Domain Waktu</u>

```
clear
clc
close

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\inner13.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\inner10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\inner2.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\inner18.mat')
y4=data_all(:,1);

% plot amplitude time domain
figure
subplot(3,2,1)
plot(y1(1:52066))
title('(a)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,2)
plot(y2(1:52066))
title('(b)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,3)
plot(y3(1:52066))
title('(c)')
ylabel('Amplitudo')
xlabel('Sampel')
subplot(3,2,4)
plot(y4(1:52066))
title('(d)')
ylabel('Amplitudo')
xlabel('Sampel')
```

b. Spektrum Frekuensi

```
clear
clc
close

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\inner13.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\inner10.mat')
y2=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\inner2.mat')
y3=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\inner18.mat')
y4=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %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
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y3 = fft(y3,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y4 = fft(y4,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,3)
plot(f,2*abs(Y3(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,4)
plot(f,2*abs(Y4(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
```

```
ylabel('Amplitudo')
```

c. Spektrum Envelope

```
clear
clc
close

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\inner13.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n1=sig_f/(norm(sig_f));
freq_s1=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\inner10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n2=sig_f/(norm(sig_f));
freq_s2=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\inner2.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;

load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\inner18.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

%envelope analysis based on Hilbert transform
figure
subplot(2,2,1);
plot(freq_s1,sig_n1);
axis ([0 2000 0 0.04]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,2);
plot(freq_s2,sig_n2);
axis ([0 2000 0 0.042]);
title('(b)')
```

```
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2000 0 0.04]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s4,sig_n4);
axis ([0 2000 0 0.04]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

4. Plot Spektrum Frekuensi dengan Spektrum Envelope Kondisi Normal dan Cacat Lintasan Luar

a. Kecepatan 1200 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\outer3.mat')
y2=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\outer3.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
```

```
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 1500 0 0.25]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 1500 0 0.25]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

b. Kecepatan 1600 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1600\outer10.mat')
y2=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1600\outer10.mat')
```

```
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 1500 0 0.25]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 1500 0 0.25]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

c. Kecepatan 2000 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data 
Skripsi\bearing\normal\rpm_2000\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\outer10.mat')
y2=data_all(:,1);
sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
```

```
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2000\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\outer10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2000 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2000 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 2000 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

d. Kecepatan 2400 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2400\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\outer10.mat')
y2=data_all(:,1);


sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2400\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\outer10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2200 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2200 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
```

```
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2200 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 2200 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

5. Plot Spektrum Frekuensi dengan Spektrum Envelope Kondisi Normal dan Cacat Lintasan dalam

a. Kecepatan 1200 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\inner13.mat')
y2=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1200\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\inner13.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
```

```
% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 2200 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 2200 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 2200 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 2200 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

b. Kecepatan 1600 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\inner10.mat')
y2=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_1600\normal10.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\inner10.mat')
analy=hilbert(data_all);
y=abs(analy);
```

```
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 1500 0 0.2]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 1500 0 0.2]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 1500 0 0.2]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 1500 0 0.2]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

c. Kecepatan 2000 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2000\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\inner2.mat')
y2=data_all(:,1);


sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
```

```
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2000\normal2.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\inner2.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
plot(freq_s3,sig_n3);
axis ([0 1500 0 0.25]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 1500 0 0.25]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

d. Kecepatan 2400 rpm

```
clear
clc
close

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_2400\normal10.mat')
y1=data_all(:,1);
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\inner18.mat')
y2=data_all(:,1);

sampling_rate=52066; %kecepatan sampling Hz
recording_time=10;   %waktu perekaman data (recording time)
L=sampling_rate*recording_time;  %panjang data (length of signal)

load('F:\SKRIPSI\Data
Skripsi\bearing\normal\rpm_241200\normal2.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n3=sig_f/(norm(sig_f));
freq_s3=(0:L-1)/T;
load('F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\inner18.mat')
analy=hilbert(data_all);
y=abs(analy);
T=recording_time;
sig_f=abs(fft(y(1:L)',L));
sig_n4=sig_f/(norm(sig_f));
freq_s4=(0:L-1)/T;

NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y1 = fft(y1,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);
NFFT = 2^nextpow2(L); % Next power of 2 from length of y
Y2 = fft(y2,NFFT)/L;
f = sampling_rate/2*linspace(0,1,NFFT/2+1);

% Plot single-sided amplitude spectrum.
figure
subplot (2,2,1)
plot(f,2*abs(Y1(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(a)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot (2,2,2)
plot(f,2*abs(Y2(1:NFFT/2+1)))
axis ([0 1500 0 0.25]);
title('(b)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')

%envelope analysis based on Hilbert transform
subplot(2,2,3);
```

```
plot(freq_s3,sig_n3);
axis ([0 1500 0 0.25]);
title('(c)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
subplot(2,2,4);
plot(freq_s3,sig_n4);
axis ([0 1500 0 0.25]);
title('(d)')
xlabel('Frequency (Hz)')
ylabel('Amplitudo')
```

6. Scrip Pengambilan Data Kondisi Normal Kecepatan 1200 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;        %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                  %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','normal');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'normal');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                       %  jumlah file yang diinginkan

data = s.startForeground();            % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_1200\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'normal',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

7. Scrip Pengambilan Data Kondisi Normal Kecepatan 1600 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;        %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                  %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','normal');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'normal');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                       %  jumlah file yang diinginkan

data = s.startForeground();            % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_1600\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'normal',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

8. Scrip Pengambilan Data Kondisi Normal Kecepatan 2000 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;
```

```
tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','normal');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'normal');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                      %  jumlah file yang diinginkan

data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_2000\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'normal',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

9. Scrip Pengambilan Data Kondisi Normal Kecepatan 2400 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','normal');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'normal');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
```

```
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                          %  jumlah file yang diinginkan

data = s.startForeground();               % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\normal\rpm_2400\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'normal',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

10. Scrip Pengambilan Data Kondisi Cacat Lintasan Luar Kecepatan 1200 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','outer');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'outer');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                          %  jumlah file yang diinginkan

data = s.startForeground();               % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);
```

```
rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1200\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'outer',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

11. Scrip Pengambilan Data Kondisi Cacat Lintasan Luar Kecepatan 1600 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;        %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                  %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','outer');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'outer');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                       %  jumlah file yang diinginkan

data = s.startForeground();            % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_1600\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'outer',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);
```

```
pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

12. Scrip Pengambilan Data Kondisi Cacat Lintasan Luar Kecepatan 2000 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','outer');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'outer');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                      %  jumlah file yang diinginkan

data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2000\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'outer',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

13. Scrip Pengambilan Data Kondisi Cacat Lintasan Luar Kecepatan 2400 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','outer');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'outer');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                      %  jumlah file yang diinginkan

data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\outer\rpm_2400\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'outer',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

14. Scrip Pengambilan Data Kondisi Cacat Lintasan Dalam Kecepatan 1200 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
```

```
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','inner');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'inner');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                      %  jumlah file yang diinginkan

data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1200\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'inner',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

15. Scrip Pengambilan Data Kondisi Cacat Lintasan Dalam Kecepatan 1600 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','inner');
```

```
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'inner');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                       %  jumlah file yang diinginkan

data = s.startForeground();            % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_1600\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'inner',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

16. Scrip Pengambilan Data Kondisi Cacat Lintasan Dalam Kecepatan 2000 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;        %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                  %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','inner');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'inner');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                       %  jumlah file yang diinginkan
```

```
data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2000\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
namafile = [rootname,'inner',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

17. Scrip Pengambilan Data Kondisi Cacat Lintasan Dalam Kecepatan 2400 rpm

```
%Script to run data acquisition using National Instrument NI 9234
%Created: Oct 2016, Berli Kamiel

clear all;
clc;
close all;

tic;

s = daq.createSession('ni');
s.DurationInSeconds = 10;       %durasi rekaman
Dur = s.DurationInSeconds;
s.Rate = 52066;                 %sampling rate Hz
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0','inner');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai1', 'inner');

s.Channels(1).Sensitivity = 100.1E-3; %V/g Type 4507B serial:30171
s.Channels(2).Sensitivity = 97.60E-3; %V/g Type 4507B serial:11026

for i=1:20                      %  jumlah file yang diinginkan

data = s.startForeground();           % start recording vibration
data
data_ch1 = data(:,1);
data_ch2 = data(:,2);

rootname = 'F:\F:\SKRIPSI\Data Skripsi\bearing\inner\rpm_2400\';
% drive tujuan dan nama file
extension = '.mat';
% ekstension utk nama file
```

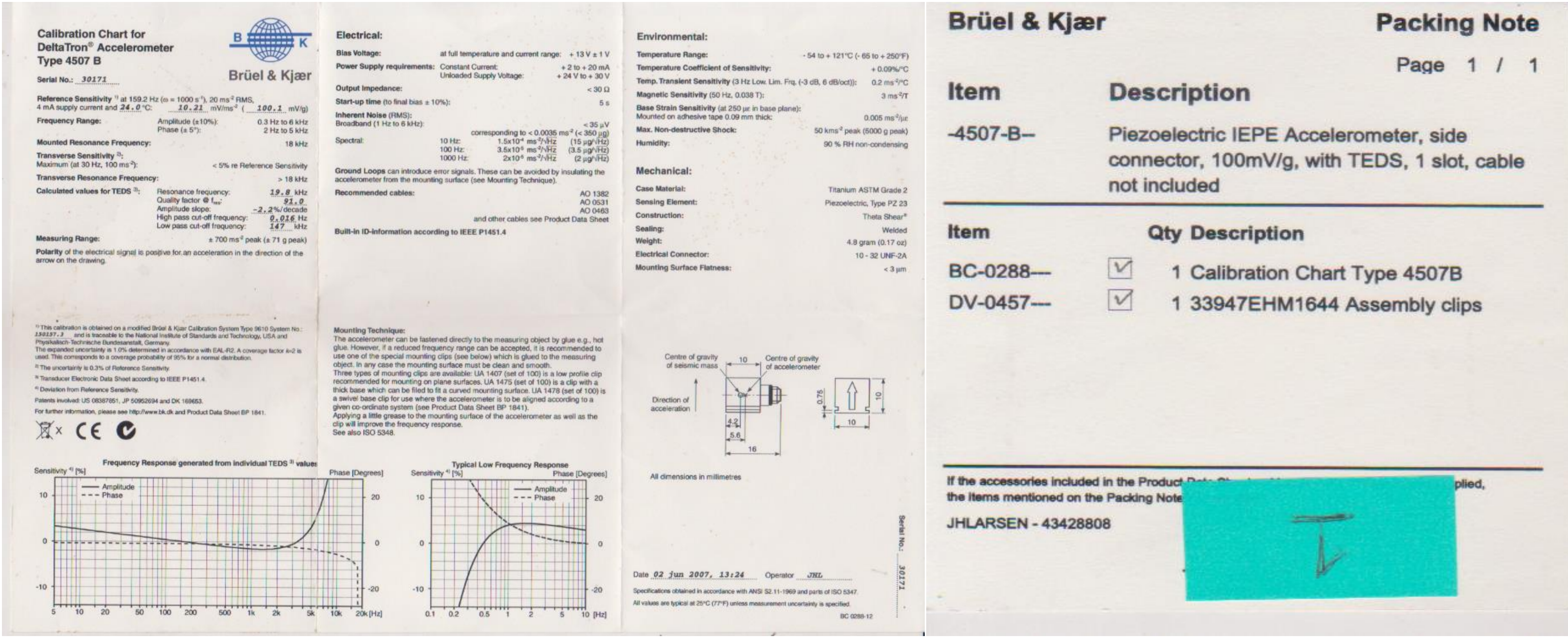
```
namafile = [rootname,'inner',num2str(i),extension];
data_all = [data_ch1 data_ch2];
eval(['save ', namafile ,' data_all']);

pause(5)
pesan = ['Acquiring and saving data at loop number: ',num2str(i)];
disp(pesan)
end

toc
```

18. Spesifikasi Sensor Akselerometer

a. Akselerometer 1



Calibration Chart for DeltaTron® Accelerometer Type 4507 B

Brüel & Kjær

Serial No.: 30171

Reference Sensitivity [1] at 159.2 Hz (ω = 1000 s^{-1}), 20 ms^{-2} RMS, 4 mA supply current and 24.0 °C: 10.21 mV/ms^{-2} (100.1 mV/g)

Frequency Range: Amplitude (±10%): 0.3 Hz to 6 kHz; Phase (± 5°): 2 Hz to 5 kHz

Mounted Resonance Frequency: 18 kHz

Transverse Sensitivity [2]: Maximum (at 30 Hz, 100 ms^{-2}): < 5% re Reference Sensitivity

Transverse Resonance Frequency: > 18 kHz

Calculated values for TEDS [3]: Resonance frequency: 19.8 kHz; Quality factor @ f_{res}: 91.0; Amplitude slope: -2.2%/decade; High pass cut-off frequency: 0.016 Hz; Low pass cut-off frequency: 147 kHz

Measuring Range: ± 700 ms^{-2} peak (± 71 g peak)

Polarity of the electrical signal is positive for an acceleration in the direction of the arrow on the drawing.

[1] This calibration is obtained on a modified Brüel & Kjær Calibration System Type 9610 System No.: 150157.3 and is traceable to the National Institute of Standards and Technology, USA and Physikalisch-Technische Bundesanstalt, Germany.
The expanded uncertainty is 1.0% determined in accordance with EAL-R2. A coverage factor k=2 is used. This corresponds to a coverage probability of 95% for a normal distribution.

[2] The uncertainty is 0.3% of Reference Sensitivity.

[3] Transducer Electronic Data Sheet according to IEEE P1451.4.

[4] Deviation from Reference Sensitivity.

Patents involved: US 08387651, JP 50952694 and DK 169653.

For further information, please see http://www.bk.dk and Product Data Sheet BP 1841.

Electrical:

Bias Voltage:	at full temperature and current range:	+ 13 V ± 1 V
Power Supply requirements:	Constant Current:	+ 2 to + 20 mA
	Unloaded Supply Voltage:	+ 24 V to + 30 V
Output Impedance:		< 30 Ω
Start-up time (to final bias ± 10%):		5 s
Inherent Noise (RMS): Broadband (1 Hz to 6 kHz):		< 35 µV corresponding to < 0.0035 ms^{-2} (< 350 µg)
Spectral:	10 Hz:	1.5x10^{-4} ms^{-2}/√Hz (15 µg/√Hz)
	100 Hz:	3.5x10^{-5} ms^{-2}/√Hz (3.5 µg/√Hz)
	1000 Hz:	2x10^{-5} ms^{-2}/√Hz (2 µg/√Hz)

Ground Loops can introduce error signals. These can be avoided by insulating the accelerometer from the mounting surface (see Mounting Technique).

Recommended cables: AO 1382, AO 0531, AO 0463 and other cables see Product Data Sheet

Built-in ID-information according to IEEE P1451.4

Mounting Technique:
The accelerometer can be fastened directly to the measuring object by glue e.g., hot glue. However, if a reduced frequency range can be accepted, it is recommended to use one of the special mounting clips (see below) which is glued to the measuring object. In any case the mounting surface must be clean and smooth.
Three types of mounting clips are available: UA 1407 (set of 100) is a low profile clip recommended for mounting on plane surfaces. UA 1475 (set of 100) is a clip with a thick base which can be filed to fit a curved mounting surface. UA 1478 (set of 100) is a swivel base clip for use where the accelerometer is to be aligned according to a given co-ordinate system (see Product Data Sheet BP 1841).
Applying a little grease to the mounting surface of the accelerometer as well as the clip will improve the frequency response.
See also ISO 5348.

Environmental:

Temperature Range:	- 54 to + 121°C (- 65 to + 250°F)
Temperature Coefficient of Sensitivity:	+ 0.09%/°C
Temp. Transient Sensitivity (3 Hz Low. Lim. Frq. (-3 dB, 6 dB/oct)):	0.2 ms^{-2}/°C
Magnetic Sensitivity (50 Hz, 0.038 T):	3 ms^{-2}/T
Base Strain Sensitivity (at 250 µε in base plane): Mounted on adhesive tape 0.09 mm thick:	0.005 ms^{-2}/µε
Max. Non-destructive Shock:	50 kms^{-2} peak (5000 g peak)
Humidity:	90 % RH non-condensing

Mechanical:

Case Material:	Titanium ASTM Grade 2
Sensing Element:	Piezoelectric, Type PZ 23
Construction:	Theta Shear®
Sealing:	Welded
Weight:	4.8 gram (0.17 oz)
Electrical Connector:	10 - 32 UNF-2A
Mounting Surface Flatness:	< 3 µm

Date 02 jun 2007, 13:24 Operator JHL

Specifications obtained in accordance with ANSI S2.11-1969 and parts of ISO 5347.

All values are typical at 25°C (77°F) unless measurement uncertainty is specified.

BC 0288-12

Serial No.: 30171

Brüel & Kjær **Packing Note**

Page 1 / 1

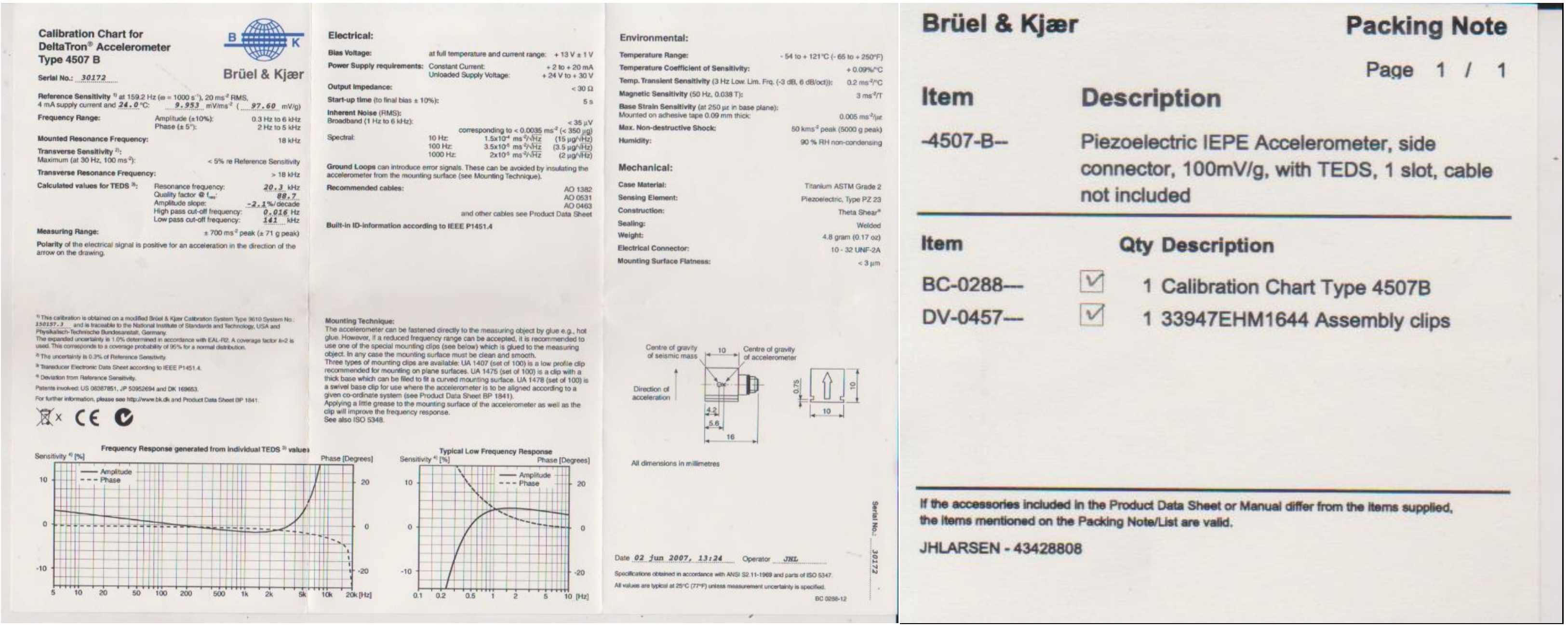
Item	Description
-4507-B--	Piezoelectric IEPE Accelerometer, side connector, 100mV/g, with TEDS, 1 slot, cable not included

Item		Qty	Description
BC-0288---	☑	1	Calibration Chart Type 4507B
DV-0457---	☑	1	33947EHM1644 Assembly clips

If the accessories included in the Product [illegible] plied, the items mentioned on the Packing Note [illegible]

JHLARSEN - 43428808

b. Akselerometer 2


Calibration Chart for DeltaTron® Accelerometer Type 4507 B

Brüel & Kjær

Serial No.: 30172

Reference Sensitivity [1] at 159.2 Hz (ω = 1000 s⁻¹), 20 ms⁻² RMS, 4 mA supply current and 24.0 °C: 9.953 mV/ms⁻² (97.60 mV/g)

Frequency Range:	Amplitude (±10%):	0.3 Hz to 6 kHz
	Phase (± 5°):	2 Hz to 5 kHz
Mounted Resonance Frequency:		18 kHz
Transverse Sensitivity [2]: Maximum (at 30 Hz, 100 ms⁻²):		< 5% re Reference Sensitivity
Transverse Resonance Frequency:		> 18 kHz
Calculated values for TEDS [3]:	Resonance frequency:	20.3 kHz
	Quality factor @ f_{res}:	88.7
	Amplitude slope:	-2.1 %/decade
	High pass cut-off frequency:	0.016 Hz
	Low pass cut-off frequency:	141 kHz
Measuring Range:		± 700 ms⁻² peak (± 71 g peak)

Polarity of the electrical signal is positive for an acceleration in the direction of the arrow on the drawing.

[1] This calibration is obtained on a modified Brüel & Kjær Calibration System Type 9610 System No.: 150157.3 and is traceable to the National Institute of Standards and Technology, USA and Physikalisch-Technische Bundesanstalt, Germany.
The expanded uncertainty is 1.0% determined in accordance with EAL-R2. A coverage factor k=2 is used. This corresponds to a coverage probability of 95% for a normal distribution.

[2] The uncertainty is 0.3% of Reference Sensitivity.

[3] Transducer Electronic Data Sheet according to IEEE P1451.4.

[4] Deviation from Reference Sensitivity.

Patents involved: US 08387851, JP 50952694 and DK 169653.

For further information, please see http://www.bk.dk and Product Data Sheet BP 1841.

Electrical:

Bias Voltage:	at full temperature and current range:	+ 13 V ± 1 V
Power Supply requirements:	Constant Current:	+ 2 to + 20 mA
	Unloaded Supply Voltage:	+ 24 V to + 30 V
Output Impedance:		< 30 Ω
Start-up time (to final bias ± 10%):		5 s
Inherent Noise (RMS): Broadband (1 Hz to 6 kHz):		< 35 µV corresponding to < 0.0035 ms⁻² (< 350 µg)
Spectral:	10 Hz:	1.5x10⁻⁴ ms⁻²/√Hz (15 µg/√Hz)
	100 Hz:	3.5x10⁻⁵ ms⁻²/√Hz (3.5 µg/√Hz)
	1000 Hz:	2x10⁻⁵ ms⁻²/√Hz (2 µg/√Hz)

Ground Loops can introduce error signals. These can be avoided by insulating the accelerometer from the mounting surface (see Mounting Technique).

Recommended cables: AO 1382, AO 0531, AO 0463 and other cables see Product Data Sheet

Built-in ID-information according to IEEE P1451.4

Mounting Technique:
The accelerometer can be fastened directly to the measuring object by glue e.g., hot glue. However, if a reduced frequency range can be accepted, it is recommended to use one of the special mounting clips (see below) which is glued to the measuring object. In any case the mounting surface must be clean and smooth.
Three types of mounting clips are available: UA 1407 (set of 100) is a low profile clip recommended for mounting on plane surfaces. UA 1475 (set of 100) is a clip with a thick base which can be filed to fit a curved mounting surface. UA 1478 (set of 100) is a swivel base clip for use where the accelerometer is to be aligned according to a given co-ordinate system (see Product Data Sheet BP 1841).
Applying a little grease to the mounting surface of the accelerometer as well as the clip will improve the frequency response.
See also ISO 5348.

Environmental:

Temperature Range:	- 54 to + 121°C (- 65 to + 250°F)
Temperature Coefficient of Sensitivity:	+ 0.09%/°C
Temp. Transient Sensitivity (3 Hz Low. Lim. Frq. (-3 dB, 6 dB/oct)):	0.2 ms⁻²/°C
Magnetic Sensitivity (50 Hz, 0.038 T):	3 ms⁻²/T
Base Strain Sensitivity (at 250 µε in base plane): Mounted on adhesive tape 0.09 mm thick:	0.005 ms⁻²/µε
Max. Non-destructive Shock:	50 kms⁻² peak (5000 g peak)
Humidity:	90 % RH non-condensing

Mechanical:

Case Material:	Titanium ASTM Grade 2
Sensing Element:	Piezoelectric, Type PZ 23
Construction:	Theta Shear®
Sealing:	Welded
Weight:	4.8 gram (0.17 oz)
Electrical Connector:	10 - 32 UNF-2A
Mounting Surface Flatness:	< 3 µm

All dimensions in millimetres

Date 02 jun 2007, 13:24 Operator JHL

Specifications obtained in accordance with ANSI S2.11-1969 and parts of ISO 5347.
All values are typical at 25°C (77°F) unless measurement uncertainty is specified.

BC 0288-12

Serial No.: 30172

Brüel & Kjær **Packing Note**

Page 1 / 1

Item	Description
-4507-B--	Piezoelectric IEPE Accelerometer, side connector, 100mV/g, with TEDS, 1 slot, cable not included

Item		Qty	Description
BC-0288---	☑	1	Calibration Chart Type 4507B
DV-0457---	☑	1	33947EHM1644 Assembly clips

If the accessories included in the Product Data Sheet or Manual differ from the items supplied, the items mentioned on the Packing Note/List are valid.

JHLARSEN - 43428808