

Measurements in calibration (aluminium) sample

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Add MLIB library

```
clear; close all; clc;
mllibfolder = '/home/ivan/Desktop/MLIB';
path(path, mllibfolder);
add_mlib_path;
```

Part I: Radial measurements

Upload measurements on Aluminium sample

```
Data = zeros(110,10000);

for ii = 1:110
    filename = ['/remote/data/ivan/Ultrasonic_data/ALU_radial_calibration/tek' mynum2st
    data = read_csv_files(filename,15,10014);
    Data(ii,:) = data(:,2);
    tt = data(:,1);
end
```

Amplitude normalization

```
nData = Data;
for i = 1:110
    nData(i,:) = Data(i,:)/max(Data(i,:));
end
```

Clip first arrival signal

```
cData = zeros(size(nData));

for i = 1:110
    trace = nData(i,:);
    [~,imax] = max(trace);
    ind = (imax-125):(imax+91);
    cData(i,ind) = nData(i,ind)-0.01;
end
```

Estimate timeshifts by cross-correlation of traces

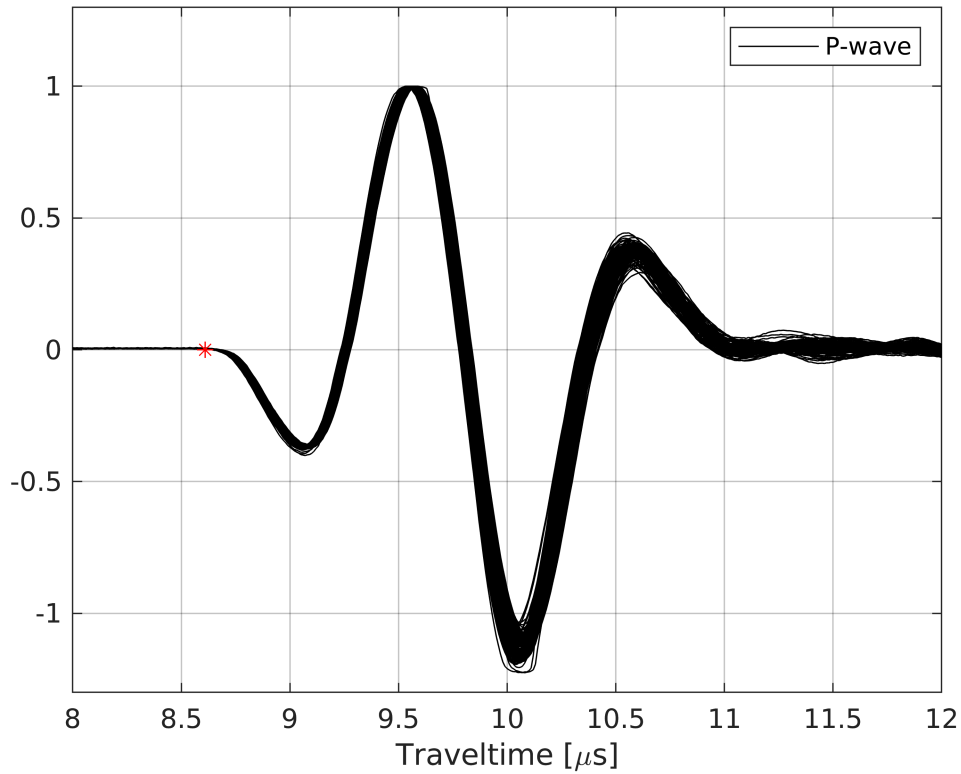
```
tP = 8.61e-6; % traveltime of P wave in Al

figure(611)
plot(1e6*tt, nData','k');
```

```

hold on
plot(1e6*tP, 0, 'r*');
axis([8, 12, -1.3 1.3])
xlabel('Traveltime [\mus]')
grid on
legend('P-wave')

```



```
dt = 1e-08
```

```
dt = 1.0000e-08
```

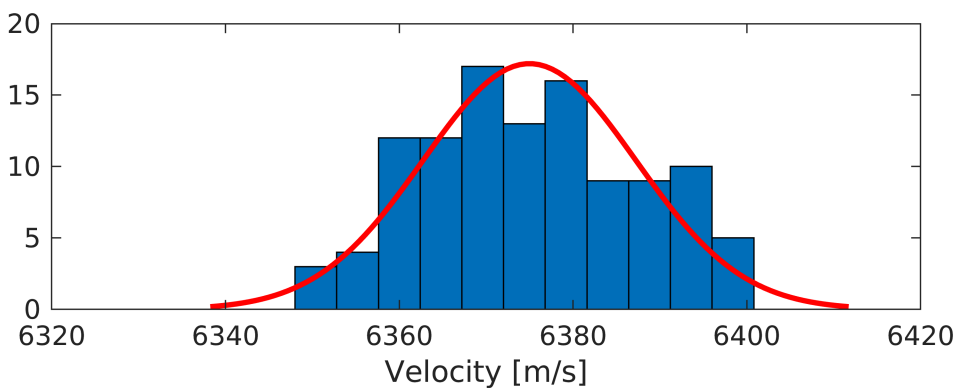
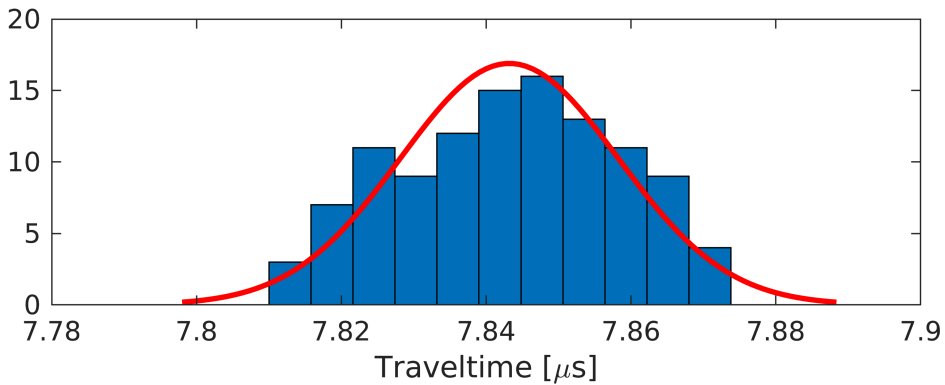
```

for i = 1:110
    trace1 = cData(1,:);
    trace2 = cData(i,:);
    [DT(i), C(i)] = mycorr(trace1, trace2, dt);
end
%[~,imax] = max(trace1);
%TT = DT + tt(imax);
%Tcor = 171.8*dt;
TT = DT + tP;
Tcor = 0.798e-6;
TT = TT - Tcor;
V = 0.050./(TT);

figure(2)
subplot(2,1,1); histfit(TT*1e6',11)
xlabel('Traveltime [\mus]')
subplot(2,1,2); histfit(V',11)

```

```
xlabel('Velocity [m/s]')
```



```
fitdist(TT', 'Normal')
```

```
ans =  
NormalDistribution  
  
Normal distribution  
mu = 7.84319e-06 [7.84034e-06, 7.84604e-06]  
sigma = 1.50611e-08 [1.32997e-08, 1.73646e-08]
```

```
fitdist(V', 'Normal')
```

```
ans =  
NormalDistribution  
  
Normal distribution  
mu = 6374.98 [6372.67, 6377.29]  
sigma = 12.2442 [10.8122, 14.1168]
```

Part II: axial measurements

$T_{Al} = 18.52 \mu\text{s}$ for P-waves in axial direction

$T_{Al} = 37.95 \mu\text{s}$ for S-waves in axial direction

```
clear all;  
  
tP = 18.52e-6;
```

```

tS = 37.95e-6;

Data = zeros(100,10000);
Wave_type = zeros(1,100);
Wave_type([1:10, 21:30, 41:50, 61:70, 81:90]) = 1;
Pressure = zeros(1,100);
Pressure(1:20) = 0;
Pressure(21:40) = 5;
Pressure(41:60) = 10;
Pressure(61:80) = 20;
Pressure(81:100) = 30;

for ii = 1:100
    filename = ['/remote/data/ivan/Ultrasonic_data/ALU_axial_calibration/org/tek' mynum
    data = read_csv_files(filename,15,10014);
    Data(ii,:) = data(:,2);
    tt = data(:,1);
end

PData = Data(Wave_type==1,:);
SData = Data(Wave_type==0,:);

```

Amplitude normalization of P-waves

```

nPData = PData;
for i = 1:50
    nPData(i,:) = PData(i,:)/max(PData(i,:));
end

```

Amplitude normalization of S-waves

```

nSData = SData;
for i = 1:50
    nSData(i,:) = SData(i,:)/max(abs(SData(i,:)));
end

figure(3)
subplot(2,1,1)
plot(1e6*tt, nPData(10,:), 'k')
hold on
plot(1e6*tP, 0, 'r*')
axis([15, 22, -1 1])
xlabel('Traveltime [\mus]')
legend('P-wave')
grid on
subplot(2,1,2)
plot(1e6*tt, nSData(10,:), 'k')
hold on
plot(1e6*tS, 0, 'r*')
axis([30, 46, -1 1])
xlabel('Traveltime [\mus]')
legend('S-wave')

```

