```
% COnstant
% P = 0.95
tp = 2.26;
kp = 1.96;
C = sqrt(3);
delta_M = 0.002;
delta_f = 50;
Cf = sqrt(3);

t_start = 25.0;
t_end = 25.2;
t = mean([t_start, t_end]);
ps = 3169.0;
H = mean([0.39, 0.38]);
pw = H * ps;
```

```
% function
fv = @(t, p, pw, vo) vo*sqrt((1 + t/273.15)*(1+0.3192*pw/p))
```

```
fv = function_handle with value:
    @(t,p,pw,vo)vo*sqrt((1+t/273.15)*(1+0.3192*pw/p))
```

```
% Data here

% f
fi = [37.215 37.211 37.200 37.183 37.186];

% 干涉法
x_gs = [5.210 5.648 6.144 6.600 7.098 7.562 8.010 8.500 8.948 9.416 9.836 10.220];

% 相位比较法
x_xw = [5.182 5.646 6.118 6.580 7.042 7.522 7.980 8.440 8.908 9.366 9.824 10.226];

% Water
x_wt = [2.114 4.690 6.864 9.012 11.106 13.048 14.676 16.412 19.082 21.352];

% 时差法
l_A = [20.856 24.700] .* 10^-2;
t_A = [105 89] .* 10^-6;

l_B = [21.864 17.900] .* 10^-2;
t_B = [153 174] .* 10^-6;
```

```
f = mean(fi) * 10^3
```

```
f =
```

```
        37199
```

```
% A.1
deltaX = diff(x_gs)
```

```
deltaX = 1×11
                    0.438                    0.496                    0.456 ···
```

```
dx_avg = mean(deltaX)
```

```
dx_avg =
         0.455454545454546
```

```
% lamda = 2 * dx_avg;
ft = fittype('poly1');
xx = (1:1:12)';
fun = fit(xx, x_gs', ft)
```

```
fun =
     Linear model Poly1:
     fun(x) = p1*x + p2
     Coefficients (with 95% confidence bounds):
       p1 =      0.4619  (0.4548, 0.469)
       p2 =       4.764  (4.711, 4.816)
```

```
lamda = 2 * fun.p1
```

```
lamda =
         0.923776223776224
```

```
v_a = f * lamda * 10^-2
```

```
v_a =
          343.635517482518
```

```
sa = std(deltaX)
```

```
sa =
        0.0341419496700574
```

```
ua = sa / sqrt(12-1)
```

```
ua =
        0.0102941851515253
```

```
Ux = sqrt((tp * ua)^2 + (kp * delta_M/C)^2)
```

```
Ux =
        0.0233746822797753
```

```
U_Lamda = 2 * Ux
```

```
U_Lamda =
        0.0467493645595507
```

```
fa = std(fi)
```

```
fa =
        0.0143701078632007
```

```
f_ua = fa / sqrt(5 - 1) * 1000
```

```
f_ua =
          7.18505393160033
```

```
Uf = sqrt((tp*f_ua)^2 + (kp * delta_f/Cf)^2)
```

```
Uf =
          58.8643625917529
```

```
U = v_a*sqrt((U_Lamda/lamda)^2 + (Uf/f)^2)
```

```
U =
          17.3987956613031
```

```
va = fv(t, ps, pw, v_a)
```

```
va =
          380.501753845227
```

```
% A.2
x_xw = x_xw';
deltaX = diff(x_xw)
```

```
deltaX = 11×1
                    0.464
                    0.472
                    0.462
                    0.462
                     0.48
                    0.458
         0.459999999999999
                    0.468
                    0.458
                    0.458
    ⋮
```

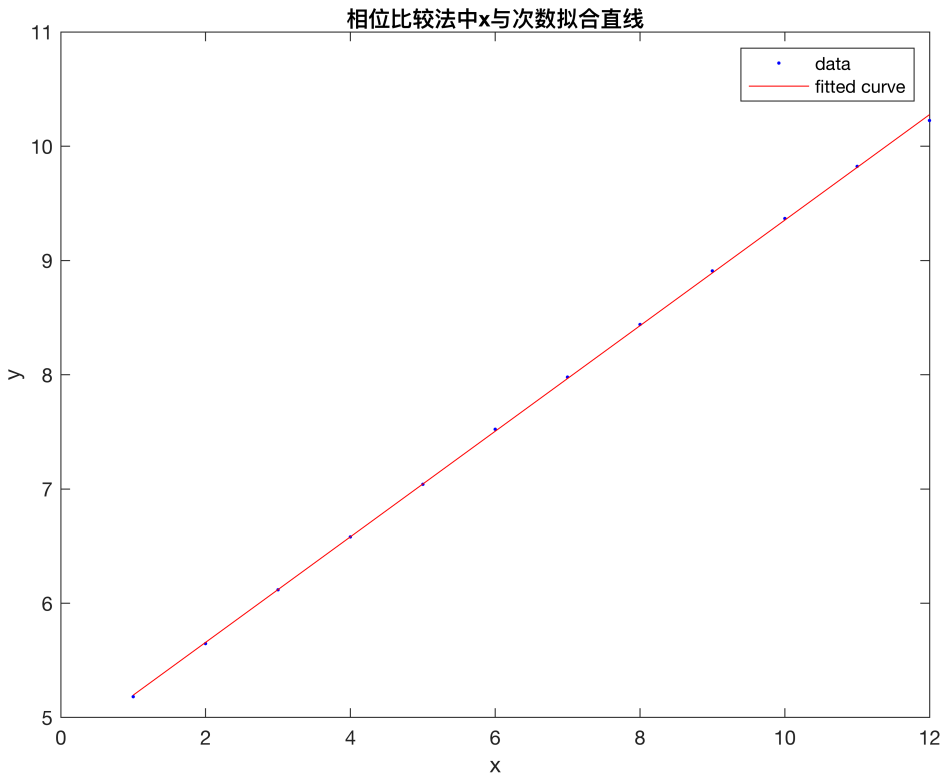
```
dx_avg = mean(deltaX)
```

```
dx_avg =
        0.458545454545455
```

```
% lamda = 2 * dx_avg;
ft = fittype('poly1');
xx = (1:1:12)';
fun = fit(xx, x_xw, ft)
```

```
fun =
     Linear model Poly1:
     fun(x) = p1*x + p2
     Coefficients (with 95% confidence bounds):
       p1 =      0.4619  (0.4582, 0.4657)
       p2 =       4.734  (4.706, 4.761)
```

```
plot(fun,xx,x_xw )
title('相位比较法中x与次数拟合直线')
```




```
lamda = 2 * fun.p1
```

```
lamda =
        0.923874125874126
```

```
v_b = f * lamda * 10^-2
```

```
v_b =
```

```
          343.671936083916
```

```
sa = std(deltaX)
```

```
sa =
        0.0199617816657912
```

```
length = size(x_gs);
ua = sa / sqrt(11-1)
```

```
ua =
       0.00631246962188902
```

```
Ux = sqrt((tp * ua)^2 + (kp * delta_M/C)^2)
```

```
Ux =
        0.0144445859585918
```

```
U_Lamda = 2 * Ux
```

```
U_Lamda =
        0.0288891719171835
```

```
fa = std(fi)
```

```
fa =
        0.0143701078632007
```

```
f_ua = fa / sqrt(5 - 1) * 1000
```

```
f_ua =
          7.18505393160033
```

```
Uf = sqrt((tp*f_ua)^2 + (kp * delta_f/Cf)^2)
```

```
Uf =
          58.8643625917529
```

```
U = v_b*sqrt((U_Lamda/lamda)^2 + (Uf/f)^2)
```

```
U =
           10.760234760638
```

```
va = fv(t, ps, pw, v_b)
```

```
va =
          380.542079542076
```

```
% A.3
x_wt= x_wt';
deltaX = diff(x_wt)
```

```
deltaX = 9×1
                    2.576
                    2.174
                    2.148
                    2.094
                    1.942
                    1.628
                    1.736
                     2.67
                     2.27
```

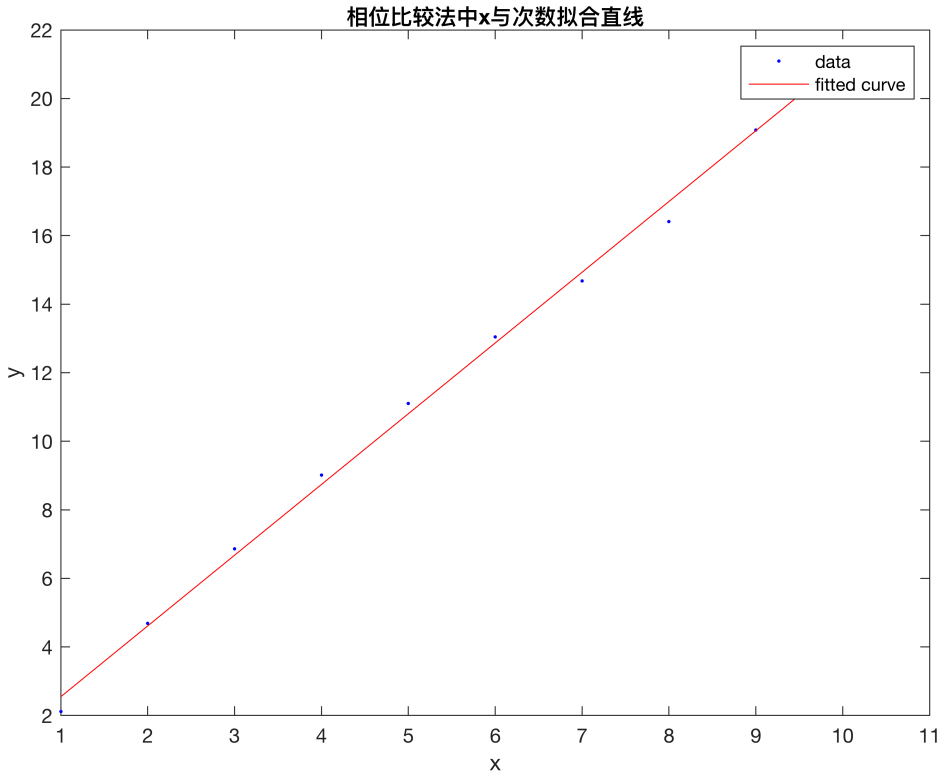
```
dx_avg = mean(deltaX)
```

```
dx_avg =
          2.13755555555556
```

```
% lamda = 2 * dx_avg;
ft = fittype('poly1');
xx = (1:1:10)';
fun = fit(xx, x_wt, ft)
```

```
fun =
     Linear model Poly1:
     fun(x) = p1*x + p2
     Coefficients (with 95% confidence bounds):
       p1 =       2.064  (1.979, 2.149)
       p2 =      0.4836  (-0.04077, 1.008)
```

```
plot(fun,xx,x_wt )
title('相位比较法中x与次数拟合直线')
```




```
lamda = 2 * fun.p1
```

```
lamda =

    4.128
```

```
v_c = f * lamda * 10^-2
```

```
v_c =

   1535.57472
```

```
sa = std(deltaX)
```

```
sa =

    0.345641111237911
```

```
length = size(x_gs);
ua = sa / sqrt(9-1)
```

```
ua =

    0.12220258680659
```

```
Ux = sqrt((tp * ua)^2 + (kp * delta_M/C)^2)
```

```
Ux =
```

```
        0.276187119278861
```

```
U_Lamda = 2 * Ux
```

```
U_Lamda =
        0.552374238557722
```

```
fa = std(fi);
length = size(fi);
f_ua = fa / sqrt(5 - 1) * 1000
```

```
f_ua =
         7.18505393160033
```

```
Uf = sqrt((tp*f_ua)^2 + (kp * delta_f/Cf)^2)
```

```
Uf =
         58.8643625917529
```

```
U = v_c*sqrt((U_Lamda/lamda)^2 + (Uf/f)^2)
```

```
U =
          205.49206027623
```

```
va = fv(t, ps, pw, v_c)
```

```
va =
          1700.3157252222
```

```
% A.4
% Material 1
vvecA = l_A ./ t_A
```

```
vvecA = 1×2
         1986.28571428571          2775.2808988764
```

```
v_bA = mean(vvecA)
```

```
v_bA =
         2380.78330658106
```

```
vvecB = l_B ./ t_B
```

```
vvecB = 1×2
         1429.01960784314          1028.73563218391
```

```
v_bB = mean(vvecB)
```

```
v_bB =
          1228.87762001352
```