

**6.19** The elevation of point  $C$  on the chimney shown in Figure 6.3 is desired. Field angles and distances are observed. Station  $A$  has an elevation of  $345.36 \pm 0.03$  ft and Station  $B$  has an elevation of  $353.86 \pm 0.03$ . The instrument height,  $hiA$ , at Station  $A$  is  $5.53 \pm 0.02$  ft and the instrument height,  $hiB$ , at Station  $B$  is  $5.52 \pm 0.02$  ft. Zenith angles are read in the field. The other observations and their estimated errors are

$$AB = 203.56 \pm 0.02 \text{ ft}$$

$$A = 43^\circ 15' 21'' \pm 6.8''$$

$$B = 42^\circ 02' 36'' \pm 5.7''$$

$$z1 = 79^\circ 22' 10'' \pm 12.3''$$

$$z2 = 83^\circ 00' 48'' \pm 9.8''$$

A. What is the elevation of the stack and the standard deviation in this elevation?

SeC =

**0.1544**

## Matlab Work/code.

```
% Elevations
eA=345.36; eB=353.86;
% errors in elevations
SeA=0.03;SeB=0.03;
% instrument height and their errors
hiA=5.53; ShiA=0.02;
hiB=5.52; ShiB=0.02;
% distance AB and error
AB=203.56; SAB=0.02;

% A = 43°15'21" ± 6.8" B = 42°02'36" ± 5.7"
% Angle A and its error
A=43+15/60+21/3600;
A=A*pi/180
SA=6.8/3600;
SA=SA*pi/180

% Angle B and its error
B=42+02/60+36/3600;
B=B*pi/180;
SB=5.7/3600;
SB=SB*pi/180

% v1 = 79°22'10" ± 12.3" v2 = 83°00'48" ± 9.8"
% Vertical angle v1 and its error
v1=79+22/60+10/3600;
v1=v1*pi/180;
Sv1=12.3/3600
Sv1=Sv1*pi/180;
% Vertical angle v2 and its error
v2=83+00/60+48/3600;
v2=v2*pi/180
Sv2=9.8/3600;
Sv2=Sv2*pi/180
%Elevation of C
eC=0.5*(eA+hiA+(AB*sin(B)*tan(v1)/sin((A+B)))+...
    eB+hiB+(AB*sin(A)*tan(v2)/sin((A+B))));
deA= 0.5;
deB= 0.5;
dhiA= 0.5;
dhiB= 0.5;
dAB= 0.5*((sin(B)*tan(v1)+sin(A)*tan(v2))/sin(A+B))

dA=0.5*AB*((-cos(A+B))*(sin(B)*tan(v1)+...
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$$\sin(A) \cdot \tan(v2)) / (\sin(A+B))^2 + (\cos(A) \cdot \tan(v2) / \sin(A+B)))$$

$$dB = 0.5 \cdot AB \cdot ((-\cos(A+B) \cdot (\sin(B) \cdot \tan(v1) + \dots \sin(A) \cdot \tan(v2)) / (\sin(A+B))^2 + (\cos(B) \cdot \tan(v1) / \sin(A+B))))$$

$$dv1 = 0.5 \cdot AB \cdot \sin(B) / (\sin(A+B) \cdot (\cos(v1))^2)$$

$$dv2 = 0.5 \cdot AB \cdot \sin(A) / (\sin(A+B) \cdot (\cos(v2))^2)$$

% Error in elevation of C

$$veC = (deA \cdot SeA)^2 + (deB \cdot SeB)^2 + (dhiA \cdot ShiA)^2 + (dhiB \cdot ShiB)^2 + \dots (dA \cdot SA)^2 + (dB \cdot SB)^2 + (dv1 \cdot Sv1)^2 + (Sv2 \cdot Sv2)^2 + (dAB \cdot SAB)^2$$

$$SeC = \sqrt{veC}$$

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>> homework\_06

A =

0.7550

SA =

3.2967e-05

SB =

2.7634e-05

Sv1 =

0.0034

v2 =

1.4489

Sv2 =

4.7512e-05

dAB =

4.5953

dA =

529.9980

dB =

327.1411

dv1 =

2.0097e+03

dv2 =

4.7298e+03

veC =

0.0238

SeC =

0.1544