

Nota Geo Tech:

Calcolo delle inclinazioni trasversali negli Inclinatori biassiali serie 900

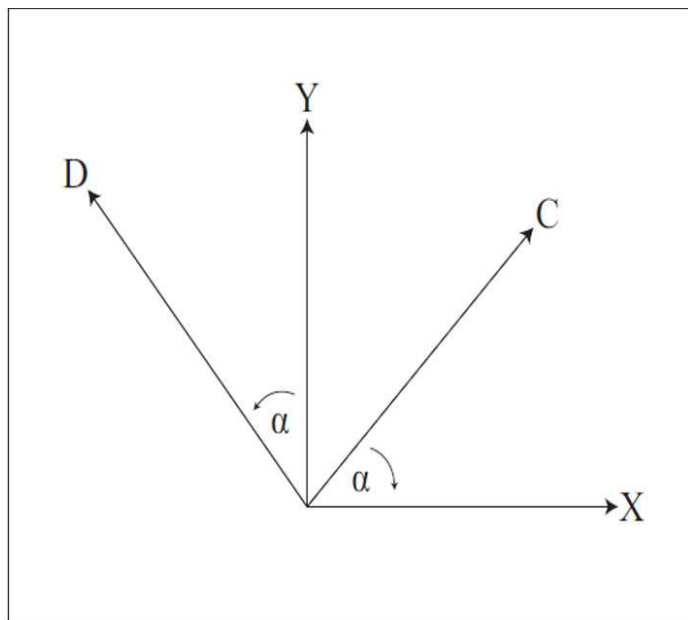


Figure 1. Plan View

Assumptions

1. Planes XY and CD are initially horizontal.
2. Scale factors, S_x and S_y for rotations in vertical planes parallel to X and Y directions are given.
3. Voltage outputs of X and Y channels, V_x and V_y , are: measured voltages minus bias (see below).
4. Bias voltages, B_x and B_y have been measured. Bias voltages are the tiltmeter's X and Y outputs when it is perfectly horizontal.

Problem

1. Rotation occurs in a vertical plane parallel to direction C.
2. Find angle α , which defines C direction.
3. Find amplitude of rotation, θ_c .

Solution

For rotation in the X or Y directions, rotation amplitude is given by

$\theta_x = S_x V_x$ and $\theta_y = S_y V_y$ where S_x and S_y are the scale factors given in the user's manual or calibration certificate.

For rotation in the C direction we define new scale factors:

$$S_c' = S_x / \cos \alpha \text{ and } S_c'' = S_y / \cos (90^\circ - \alpha)$$

The rotation amplitude in the C direction then becomes:

$$\theta_c = S_c' V_x = (S_x / \cos \alpha) (V_x) \quad [1]$$

$$\theta_c = S_c'' V_y = [S_y / \cos (90^\circ - \alpha)] (V_y) \quad [2]$$

Equating [1] and [2] and solving gives:

$$\frac{S_x V_x}{\cos \alpha} = \frac{S_y V_y}{\cos (90^\circ - \alpha)}$$
$$\frac{S_x V_x}{S_y V_y} = \frac{\cos \alpha}{\cos (90^\circ - \alpha)} = \frac{1}{\tan \alpha}$$

$$\alpha = \tan^{-1} \left[\frac{S_y V_y}{S_x V_x} \right] \quad [3]$$

Substituting α in equation [1] or [2] along with the known values of S_x and V_x , or S_y and V_y gives the rotation angle, θ_c .

Summary: Steps in Measuring Cross-Axis Tilt Angle, θ_c

1. Measure bias voltages, B_x and B_y on both tilt channels.
2. Subtract B_x and B_y from measured voltages to obtain corrected outputs V_x and V_y for use in eqns. [1] through [3].
3. Compute α from equation [3] using known scale factors S_x and S_y .
4. Compute θ_c from equation [1] or [2].