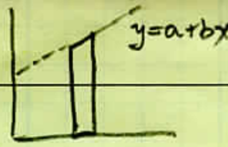
S-integral

MRN 055



Borehole tomography

$$\int_{x=x_1}^{x=x_2} dx \int_{y=0}^{y=a+bx} dy \left\{ (x-x_0)^2 + (y-y_0)^2 \right\} =$$

note

$$\int_{a_1}^{a_2} (a-a_0)^2 da = \frac{1}{3}\left\{ (a_2-a_0)^3 - (a_1-a_0)^3 \right\}$$

$$\int_{x=x_1}^{x=x_2} dx \left\{ (a+bx)(x-x_0)^2 + \frac{(a+bx-y_0)^3}{3} - \frac{(-y_0)^3}{3} \right\} =$$

$$\int_{x_1}^{x_2} dx \left\{ \overset{1.}{a(x-x_0)^2} + \overset{2.}{bx(x-x_0)^2} + \overset{3.}{\tfrac{1}{3}(bx+a-y_0)^3} + \overset{4.}{\tfrac{1}{3}y_0^3} \right\}$$

1. $\frac{a}{3}\left\{ (x_2-x_0)^3 - (x_1-x_0)^3 \right\}$

2. $b\int_{x=x_1}^{x=x_2} x(x-x_0)^2 dx =$ $\qquad x' = x-x_0 \qquad dx = dx' \qquad x = x'+x_0$

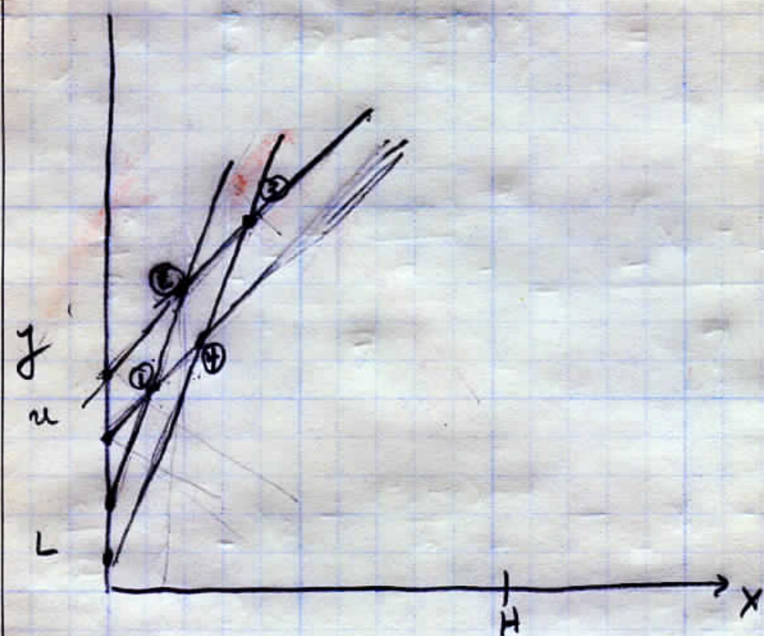
$x = x_2 \quad x' = x_2 - x_0 \qquad x = x_1 \quad x' = x_1 - x_0$

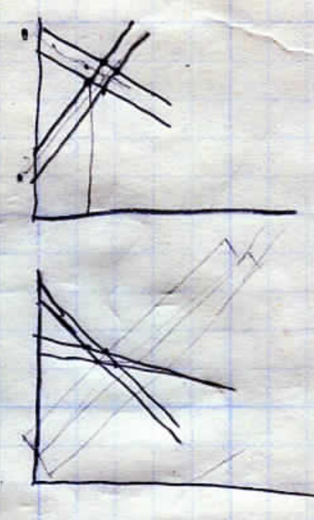
$$b\int_{x'=x_1-x_0}^{x'=x_2-x_0} (x'+x_0)\, x'^2 dx' =$$

$$b\int_{x'=x_1-x_0}^{x'=x_2-x_0} dx' \left\{ x'^3 + x_0 x'^2 \right\} = \left. \frac{bx'^4}{4} + \frac{bx_0x'^3}{3} \right|_{x'=x_1-x_0}^{x'=x_2-x_0}$$

$$= \frac{b(x_2-x_0)^4}{4} + \frac{bx_0(x_2-x_0)^3}{3} - \frac{b(x_1-x_0)^4}{4} - \frac{bx_0(x_1-x_0)^3}{3}$$

I J IJ





$y = a_1 + b_1 x$

$y = a_2 + b_2 x$

trap(a, b, x_1, x_2, J)

intersection at $\quad a_1 + b_1 x = a_2 + b_2 x$

$$(b_1 - b_2)x = (a_2 - a_1)$$

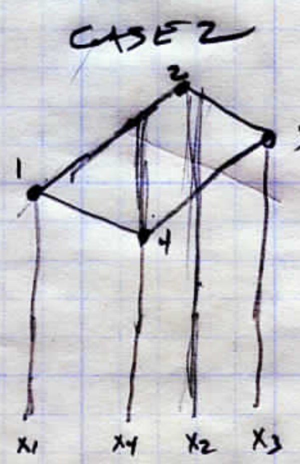
$x = -(a_2 - a_1)/(b_2 - b_1)$

$y = a_1 - b(a_2 - a_1)/(b_2 - b_1)$

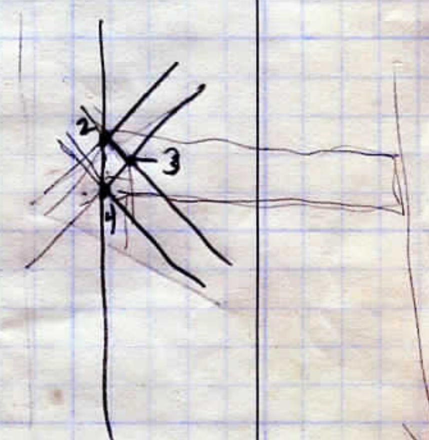
CASE 1

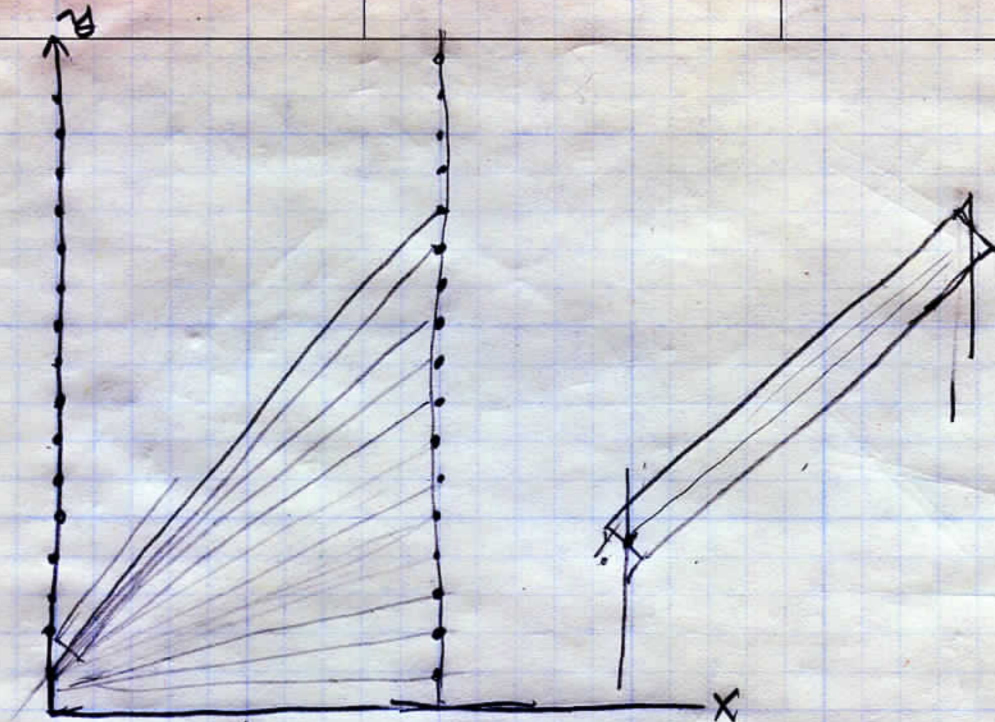
x_1	x_2	x_4	x_3
	(1-2)	(2-3)	(2-3)
	(1-4)	(1-4)	(4-3)
	Lu	uu	uu
	uL	uL	LL

CASE 2



x_1	x_4	x_2	x_3
	(1-2)	(1-2)	(2-3)
	(1-4)	(4-3)	(4-3)
	Lu	Lu	uu
	uL	LL	LL





H

$p =$ # of positions $y = 1, 2, 3, \ldots, p$

$H =$ distance between boreholes

All possible observation

y_i, y_j $\qquad$ a, b, w, θ angle w/ horizontal

$N \le p^2$ except might throw some out $\qquad$ int $\quad$ slope $\quad$ half width along y

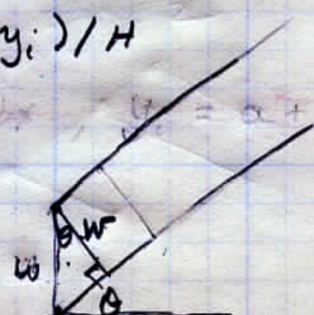
end points : $(0, y_i)$ (H, y_j)

slope $= b = (y_j - y_i)/H$

intercept $a = y_i$

$\theta = \tan^{-1} b$

$w = W/\cos\theta$



$\cos\theta = \dfrac{W}{w}$