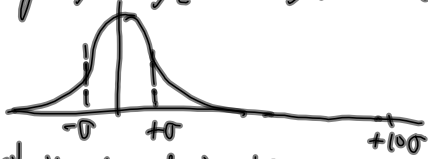


Lect 13 Comments on HW 1

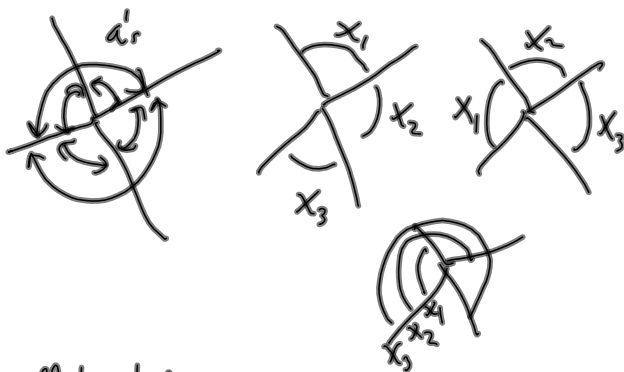
13-1

- always show n, n_0, r
- always compute, show, [comment] residuals



- state what you are doing if not obvious
 - for I/O $u = n_0$
 $c = n$, 1 obs. per equation
 - for O/O $c = r$, r cond. eqns. among d 's + constants
if scalar: select no v 's, express remaining v 's in terms of selected ones
- OR
- use LM + don't worry about selection
- for nesting method ALWAYS use LM
- when selecting parameters - if appropriate make a sketch
 - for pars use different letters than observations

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13-2

collaboration on HW

working together OK, make sure that you have your all computations

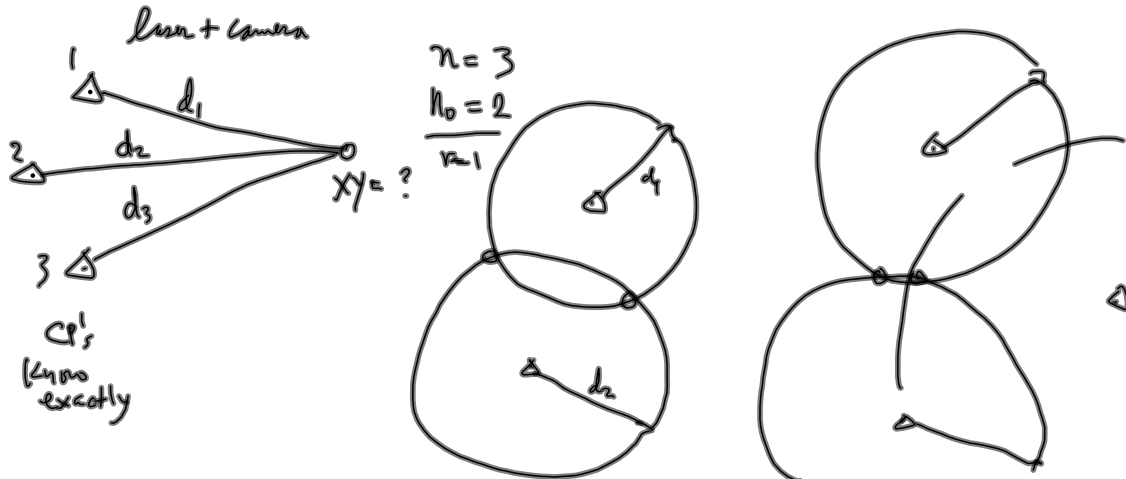
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Examples of Nonlinear LS solutions 13-3

1. I/O, 2. O/O

2D range problem: trilateration

obs. $\left. \begin{array}{l} \text{taping} \\ \text{laser} \\ \text{microwave} \\ \text{audio} \end{array} \right\} \text{phase/TOF}$



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I/O $n_0=2$, select as pairs X, Y 13-4

$$d_i = \left[(\hat{x} - x_i)^2 + (\hat{y} - y_i)^2 \right]^{1/2}$$

$$d_1 = \left[(\hat{x} - x_1)^2 + (\hat{y} - y_1)^2 \right]^{1/2}$$

$$d_2 = \left[(\hat{x} - x_2)^2 + (\hat{y} - y_2)^2 \right]^{1/2}$$

\vdots

$$F_i = d_i - \left[(\hat{x} - x_i)^2 + (\hat{y} - y_i)^2 \right]^{1/2} = 0$$

"O - C"

$$\frac{\partial F_i}{\partial x} = -\frac{1}{2} \left[\cdot \right]^{-1/2} 2(\hat{x} - x_i) \cdot 1$$

$$= -\frac{(\hat{x} - x_i)}{D_i}$$

$$D_i = \left[(\hat{x} - x_i)^2 + (\hat{y} - y_i)^2 \right]^{1/2}$$

$$\frac{\partial F_i}{\partial y} = -\frac{(\hat{y} - y_i)}{D_i}$$

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$$\begin{array}{lll} x_1, y_1 & 9, 14 & d_1 \quad 10.2 \\ x_2, y_2 & 8, 12 & d_2 \quad 11.0 \\ x_3, y_3 & 10, 10 & d_3 \quad 9.5 \end{array} \quad /3-5$$

$$f = -F_i(d, x^0, y^0)$$

$$B = \begin{bmatrix} \frac{\partial F_1}{\partial x} & \frac{\partial F_1}{\partial y} \\ \frac{\partial F_2}{\partial x} & \frac{\partial F_2}{\partial y} \\ \frac{\partial F_3}{\partial x} & \frac{\partial F_3}{\partial y} \end{bmatrix} \quad f = \begin{bmatrix} -F_1 \\ -F_2 \\ -F_3 \end{bmatrix} \quad W = I_3$$

$$x^0 = 19, y^0 = 12.6$$

$$B = \begin{bmatrix} -.9903 & .1386 \\ -.9985 & -.0544 \\ -.9607 & -.2775 \end{bmatrix} \quad f = \begin{bmatrix} -.1024 \\ +.0163 \\ -.1319 \end{bmatrix}$$

$$\Delta = (B^T W B)^{-1} B^T W f = \begin{bmatrix} .0672 \\ .0925 \end{bmatrix}$$

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