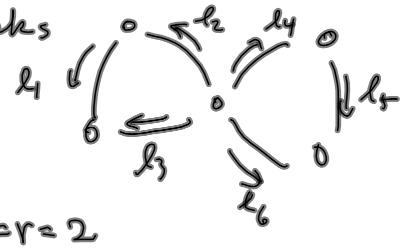
level networks



10-1

$n = 6$

$n_0 = 4$

$r = 2$

obs. only $c = r = 2$

$\hat{l}_2 + \hat{l}_1 - \hat{l}_3 = 0$

$\hat{l}_4 + \hat{l}_5 - \hat{l}_6 = 0$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} a & b \\ -b & a \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} x & y & 1 & 0 \\ y & -x & 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix}$$

$$\begin{pmatrix} v_{x'} \\ v_{y'} \end{pmatrix} + \begin{pmatrix} -x & -y & -1 & 0 \\ -y & x & 0 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix} = \begin{pmatrix} -x' \\ -y' \end{pmatrix}$$

$v \quad + \quad B \quad \Delta = f$

$n = 10$ (5 pts)

$n_0 = 4$

$r = 6$

$$\begin{bmatrix} v_{x_1'} \\ v_{y_1'} \\ v_{x_2'} \\ v_{y_2'} \\ \vdots \\ v_{x_5'} \\ v_{y_5'} \end{bmatrix} + \begin{bmatrix} -x_1 & -y_1 & -1 & 0 \\ -y_1 & x_1 & 0 & -1 \\ -x_2 & -y_2 & -1 & 0 \\ -y_2 & x_2 & 0 & -1 \\ & \vdots & & \\ -x_5 & -y_5 & -1 & 0 \\ -y_5 & x_5 & 0 & -1 \end{bmatrix}\begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} -x_1' \\ -y_1' \\ -x_2' \\ -y_2' \\ \vdots \\ -x_5' \\ -y_5' \end{bmatrix}$$

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$5x + 3y = 7$ linear in x, y

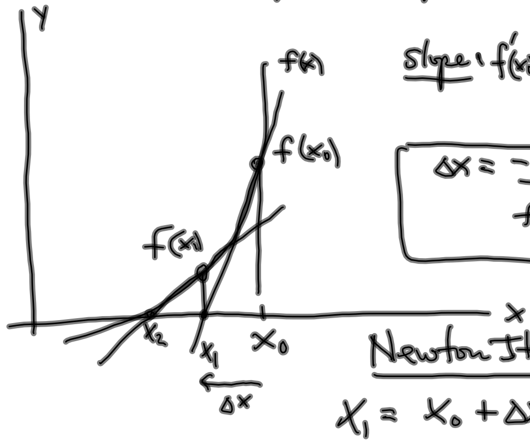
10-2

$x^2 + \sin(y) = 10$ non linear in x, y

if linear then: al most constant coefficient

if nonlinear in <u>any</u> unknown, then must treat as nonlinear problem

$f(x) = 0$, finding a root of $f(x)$



<u>slope</u>: $f'(x_0) = \dfrac{f(x_0)}{-\Delta x}$

$$\boxed{\Delta x = \dfrac{-f(x_0)}{f'(x_0)}}$$

<u>Newton Iteration</u>

$x_1 = x_0 + \Delta x$

$x_{i+1} = x_i + \Delta x$

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10-3

$$f(x) = f(x_0) + f'(x_0)(x-x_0) + \frac{f''(x_0)}{2!}(x-x_0)^2 + \dots$$

$$f(x) \approx f(x_0) + f'(x_0)\underbrace{(x-x_0)}_{\Delta x} = 0$$

$$f'(x_0)\cdot\Delta x = -f(x_0)$$

$$\boxed{\Delta x = \frac{-f(x_0)}{f'(x_0)}}$$

same as intuition from graphical derivation

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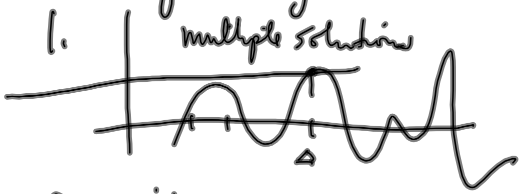
What can go wrong with this? 10-4

1. multiple solutions



2. divergence
3. mistakes...

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multivariate 10-5

$$f(x,y) = f(x_0,y_0) + \frac{\partial f}{\partial x}\Delta x + \frac{\partial f}{\partial y}\Delta y$$

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