Problems:

- Well conditioned
- Ill conditioned

Problem well conditioned: small part in input, small perturbation in output.
Algorithm \approx \text{well conditioned.}

Alg is just a way of doing a public

\[ \text{Solve a linear sys of eqn.} \]

\[ \text{Requires an input of matrix, condition number.} \]

\[ \text{w or w/o substitution} \]

Ill Conditioned Alg

\[ \text{Can lead to overfitting.} \]

\[ \text{Inverting a matrix} \rightarrow \text{BAD} \]

\[ \text{Can scale.} \]

\[ \text{SVD or QR decomps.} \]
Chrisy be approved by Robert.

In reality, it's very difficult to do so and can be

Enlist them. Have them fill in the

Cheryl. Have them fill in the

Problems or issues you feel (cut)
Recon from F.T. Phase

\[ X(\omega_1, \omega_2) = \left| \frac{1}{|e^{j4\pi N}|} \right| e^{-j\omega_1 n_1} e^{-j\omega_2 n_2} \]

\[ X(\omega_1, \omega_2) = \sum_{n_1} \sum_{n_2} x(n_1, n_2) e^{-j\omega_1 n_1} e^{-j\omega_2 n_2} \]

Need to sample \( \Theta \) at large sampling rate (from \( N \times N \)) say 2\( N \times 2\pi \)...

\( \rightarrow \) Patrick Van Hove, \( \approx 1982 \).
Given $2N \times 2N$ samples of $\mathcal{O}(w_1, w_2)$
Given signal

$N \times N$ region of support

Find signal \( x \)

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Flowchart:

1. Initial guess $y\left(n_1, n_2\right)$ $N \times N$
2. $2N \times 2N$ DFT $Y\left(k_1, k_2\right)$
3. Set signal $y$ to zero outside $N \times N$ region
4. $F^{-1}$ to get $2N \times 2N$ signal
5. Keep magnitude $\phi_y$ of $y$. Replace $\phi_y$ with $\phi_x$

Stop: Yes \( \Rightarrow \) No
Another Alg. (Closed Form Soln.)
For Recom from F.T. Phases:

\[ X(w_1, w_2) = \sum_{n_1} \sum_{n_2} x(n_1, n_2) e^{-j\omega_1 n_1} e^{-j\omega_2 n_2} \]

\[
= \left| X(w_1, w_2) \right| e^{i \phi_x(w_1, w_2)}
\]

\[
\tan \phi_x(w_1, w_2) = \frac{\text{Im}[X(w_1, w_2)]}{\text{Re}[X(w_1, w_2)]}
\]

\[
\tan \phi_x(w_1, w_2) = -\sum_{n_1} \sum_{n_2} x(n_1, n_2) \sin(w_1 n_1 + w_2 n_2)
\]

\[
\sum_{n_1} \sum_{n_2} x(n_1, n_2) \cos(w_1 n_1 + w_2 n_2)
\]

\(n^2\) sample of \(x(n_1, n_2)\) \(\rightarrow\) unknowns \(\rightarrow\) linear syst of eqns in \(n_1, n_2\) unknowns
Reconstruction of 2D signals/surfaces from level crossings.

- Dual to the product of real from phase.
- Same as recon from 1 bit of phase.
- Dual to recon from zero crossing.
- One level crossing of signal in space.

$x(t)$

$X(f)$

Impulse response.

Level crossings.

$X(f)$

Lowpass.

ID Signal $\rightarrow$ Count recon of ID signal from zero crossing.
Logan... 2D signal
Bandpass
2D signal can be near
under certain conditions
from your writing X(\xi,\eta)

\[ Z = \int_{-\pi}^{\pi} F(K_x, K_y) e^{j2\pi K_x x + j2\pi K_y y} dK_x dK_y \]

Curtis & Oppenheim: \[ \sum_{m,k} k \propto \alpha \]

2D linear system
If \( f(x,y) \) is a 2D polynomial in \( W \) and \( W^2 \)

\[
5W^2 + 2W^2Z^2 + \ldots
\]

one level crossing is enough to repeat signal. Practically need to know location of level crossing to high

Spectrum of complex signal

1.05 opposition bit
2.05 bit of amplitude

2.05 digit

Zero crossing overleaf

20

Recall from multiple level noise trade off position bits with amplitude

10.75