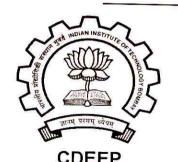
$$E = \sum_{N=-\infty}^{\infty} (x(n) - \hat{x}(n))^{2}$$

$$= \sum_{N=-\infty}^{\infty} \{x(n) - \sum_{N=1}^{p} a_{N} x(n-k)\}^{2}$$

$$= \sum_{N=-\infty}^{\infty} \{x(n) - \sum_{N=1}^{p} a_{N} x(n-k)\}^{2}$$



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To solve for the unknown model parants {au} (for chosen p):

We set $\frac{\partial E}{\partial i} = 0$ for $i = 1, \dots, p$

da:

=)
$$Z \left(x \left(n \right) - \sum_{k=1}^{p} a_k x \left(n - k \right) \right) \times - x \left[n - i \right] = 0$$

(5) =)
$$\sum_{n} x(n) \cdot x(n-i) = \sum_{k=1}^{p} a_k \sum_{n} x(n-i) x(n-k) \dots (5)$$

=) $r(i) = \sum_{k=1}^{p} a_k r(i-k) , i=1 \dots p$
($r(i) = \sum_{k=1}^{p} a_k r(i-k) = \sum_{k=1}^{p} a_k$

$$\begin{bmatrix} r[0] & v[1] & \dots & r[p-1] \\ r[1] & r[0] & r[p-2] \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_p \end{bmatrix} = \begin{bmatrix} r[1] \\ r[2] \\ \vdots \\ r[p] \end{bmatrix}$$



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 $\frac{1}{2} \cdot \cdot \cdot \cdot \cdot = \frac{1}{2} \cdot = \frac{1}$

px p matrix

of elements r[1i-41]

1 Sink & p

"Toeplitz" & R

< solve for A

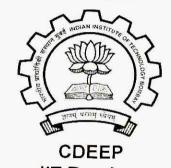
(r(1), r[2], ... r[p])

A = (a, a, ... ap)

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Now, let us consider E at optimal {au}

$$E = \sum_{n} (x(n) - \sum_{k=1}^{t} a_k x(n-k))^2$$



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Substitute (5) in above: we can show

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Emin =
$$2x^2[n] - \sum_{k=1}^{r} a_k \sum_{n} x(n-k) x(n)$$

= $r[0] - \sum_{k=1}^{r} a_k r[k]$