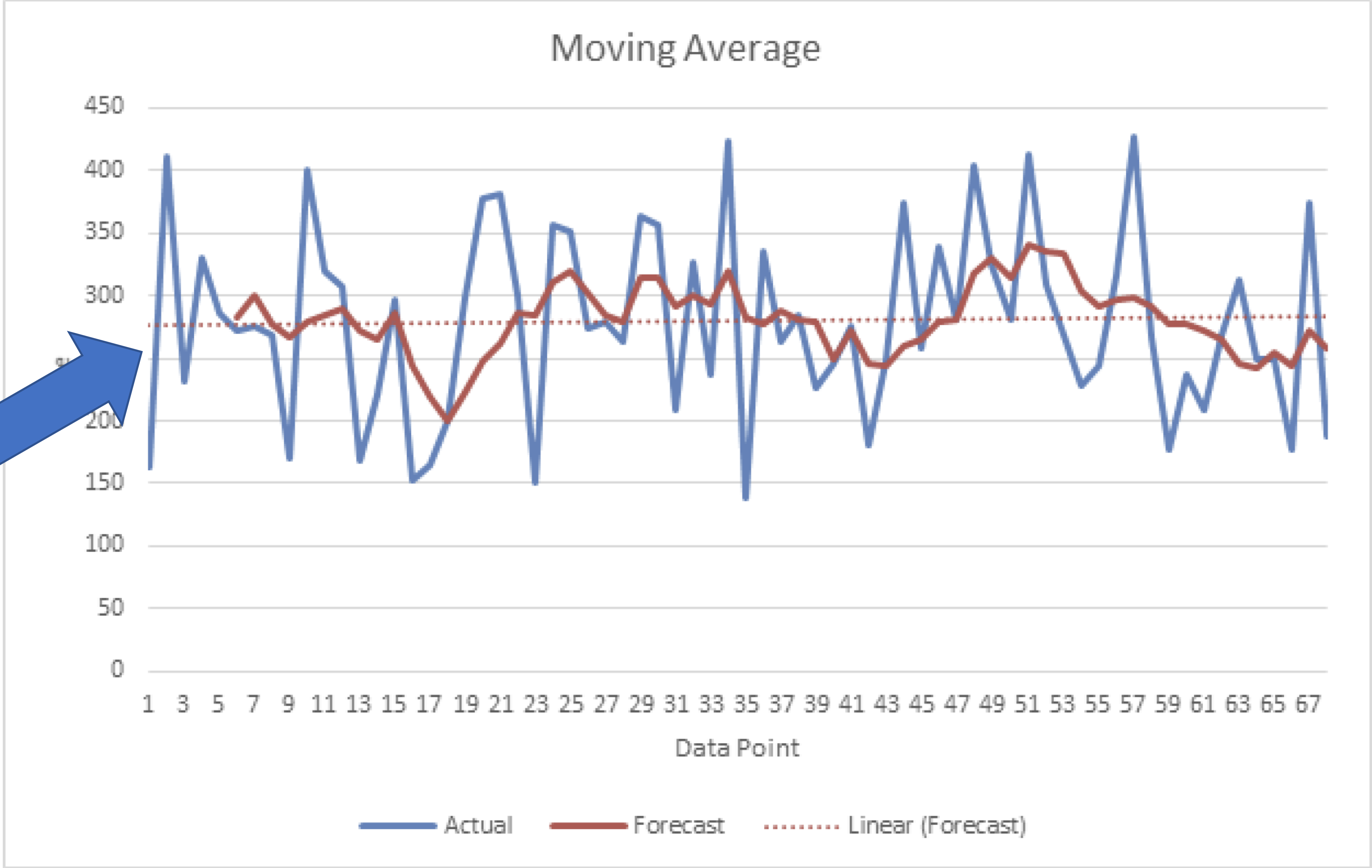
3315_Ch4_6_Presentation2

FIR FILTERS

RECORD ON

How to Use Moving Average Filter to Counter Noisy Data Signal?

8 Points



DELAY

The causal running average (5.4) is a special case of the general causal difference equatio

$$y[n] = \sum_{k=0}^{M} b_k x[n-k] = b_0 x[n] + b_1 x[n-1] + \cdots + b_M x[n-M] \quad (5.5$$

where the coefficients b_k are fixed numbers. Usually the b_k coefficients are not a the same, and then we say that (5.5) defines a ***weighted running average*** of $M +$ samples. The 3-point running average (5.4) is the case where $M = 2$ and $b_k = 1/3$ (5.5). It follows from (5.5) that the computation of $y[n]$ involves the samples $x[\ell]$ f $\ell = n, n-1, n-2, \ldots, n-M$ (i.e., $x[n], x[n-1], x[n-2]$, etc). Figure 5-4 illustrat how the causal FIR filter uses $x[n]$ and the past M samples to compute the output. Sir the sum in (5.5) does not involve future samples of the input, the system is causal, ar therefore, the output cannot start until the input becomes nonzero.[8]

GENERAL FIR FILTER

- FILTER COEFFICIENTS $\{b_k\}$
  - DEFINE THE FILTER

$$y[n] = \sum_{k=0}^{M} b_k x[n-k]$$

  - For example,

$$b_k = \{3, -1, 2, 1\}$$

$$y[n] = \sum_{k=0}^{3} b_k x[n-k]$$
$$= 3x[n] - x[n-1] + 2x[n-2] + x[n-3]$$

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Convolution is the process by which an input interacts with an LTI system to produce an output:

$$\boxed{y[n] = h[n] * x[n]}$$

LINEAR AND TIME-INVARIANT SYSTEMS

P 169 OUTPUT OF FIR FILTER

CONVOLVE $$y[n] = \sum_{k=0}^{M} b_k x[n-k]$$ Eq 5.24

ASSUMING $h[m] = 0$ for $m < 0$

$$y[n] = \sum_{k=0}^{M} h[k] x[n-k]$$ Eq 5.13 P 161

Impulse Response

but $$h[n] = \sum_{k=0}^{M} b_k \delta[n-k] = \begin{cases} b_n & n = 0, 1, \dots M \\ 0 & \text{otherwise} \end{cases}$$

Eq pg 160

REVIEW PREVIOUS LECTURES AND HOMEWORKS FOR CONVOLUTION

RECORD OFF