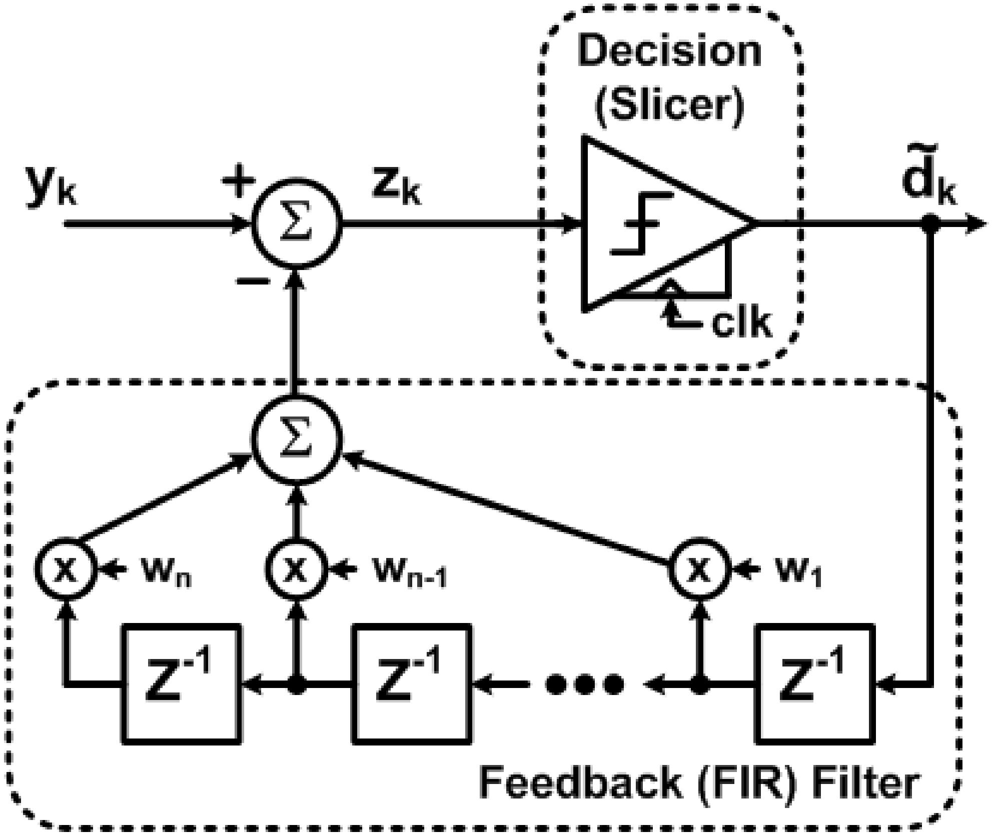
RX Decision Feedback Equalization (DFE)

- DFE is a **non-linear** equalizer
- Slicer makes a **symbol decision**, i.e. quantizes input
- ISI is then directly subtracted from the incoming signal via a feedback FIR filter

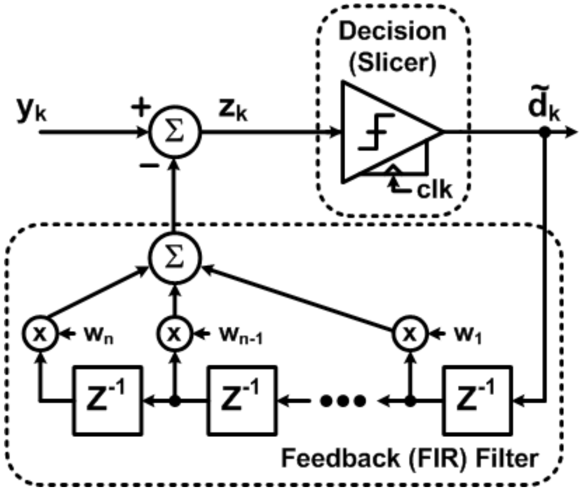
$$z_k = y_k - w_1 \tilde{d}_{k-1} \cdots - w_{n-1} \tilde{d}_{k-(n-1)} - w_n \tilde{d}_{k-n}$$

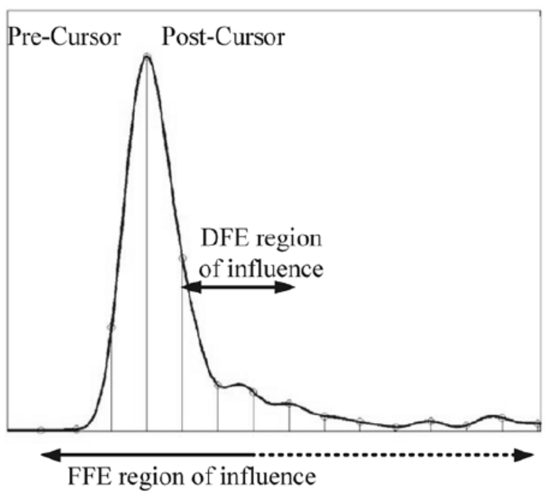


RX Decision Feedback Equalization (DFE)

- Pros
  - Can boost high frequency content without noise and crosstalk amplification
  - Filter tap coefficients can be adaptively tuned without any back-channel
- Cons
  - Cannot cancel pre-cursor ISI
  - Chance for error propagation
    - Low in practical links ($BER=10^{-12}$)
  - Critical feedback timing path
  - Timing of ISI subtraction complicates CDR phase detection

$$z_k = y_k - w_1 \tilde{d}_{k-1} \cdots - w_{n-1} \tilde{d}_{k-(n-1)} - w_n \tilde{d}_{k-n}$$

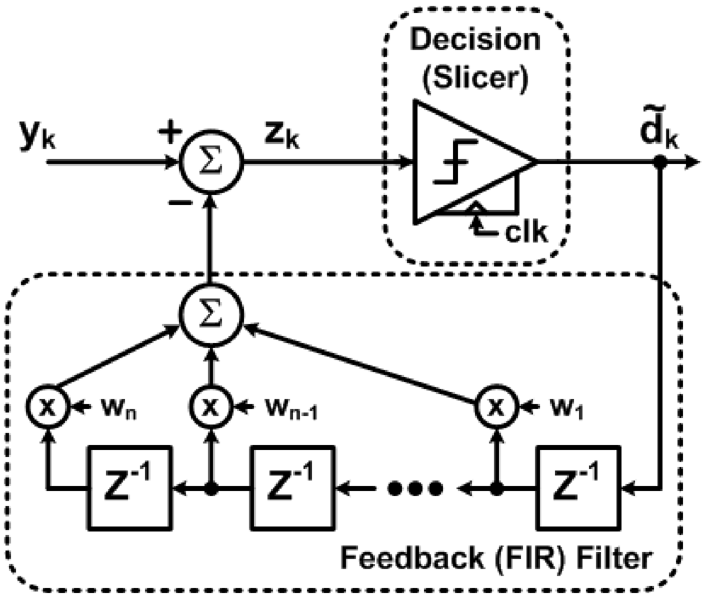




[Payne]

DFE Example

- If only DFE equalization, DFE tap coefficients should equal the unequalized channel pulse response values $[a_1\ a_2\ \dots\ a_n]$
- With other equalization, DFE tap coefficients should equal the pre-DFE pulse response values



$$[w_1\ w_2]=[a_1\ a_2]$$