Offset Cancellation Overview

- Two main ideas/approaches

- Modulate and/or filter offset so that it is outside of signal band
  - Correlated Double Sampling (auto-zero)
  - Chopping (synch. detection, DEM)

- Inject a “DC” signal that opposes the offset
  - AC-coupling or Feedback-based
  - Trimming - often digitally controlled (especially for comparators)
Filtering/Modulating Offset

- **General idea:**
  - Put elements around the amplifier that treat offset differently than signal

- **CDS:**
  - Configure amplifier so that offset is (approx.) differentiated
    - We’ll talk more about this one after we introduce discrete time circuits

- **Chopping:**
  - Modulate offset to frequencies beyond signal band, then filter it out

Chopping (1)
Chopping (2)

Nested Chopper Amplifier

- Inner chopper at high freq. to remove 1/f noise
- Outer chopper at low frequency to minimize “spiking” and remove residual offset from inner chopper.
AC Coupling for Offset Cancellation

AC Coupled Sizing Methodology
Offset Trimming

Digital Trimming
Comparator Trimming

Trim Implementation Issues

- Infinite number of ways to introduce digitally controlled offset
  - People have tried just about all of them

- Key issues:
  - Power overhead
  - Circuit Imbalance
  - Effective resolution
  - Area overhead
Comparator Trim Schemes

Pre-Amp Trim
Pre-Amp Trim

AC-Coupled Again