

EE 240B – Spring 2018

Advanced Analog Integrated Circuits Lecture 21: Offset Cancellation



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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)

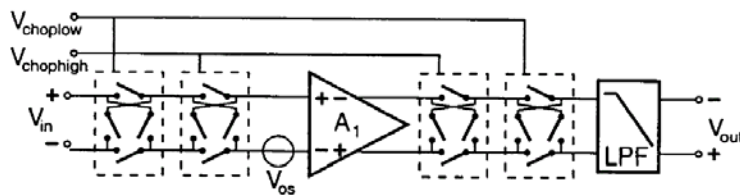
Chopping (2)

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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.

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AC Coupling for Offset Cancellation

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AC Coupled Sizing Methodology

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Auxiliary Amplifier Offset Cancellation

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Aux. Amplifier Implementation

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Offset Trimming

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Digital Trimming

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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

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Pre-Amp Trim

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Pre-Amp Trim

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AC-Coupled Again

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