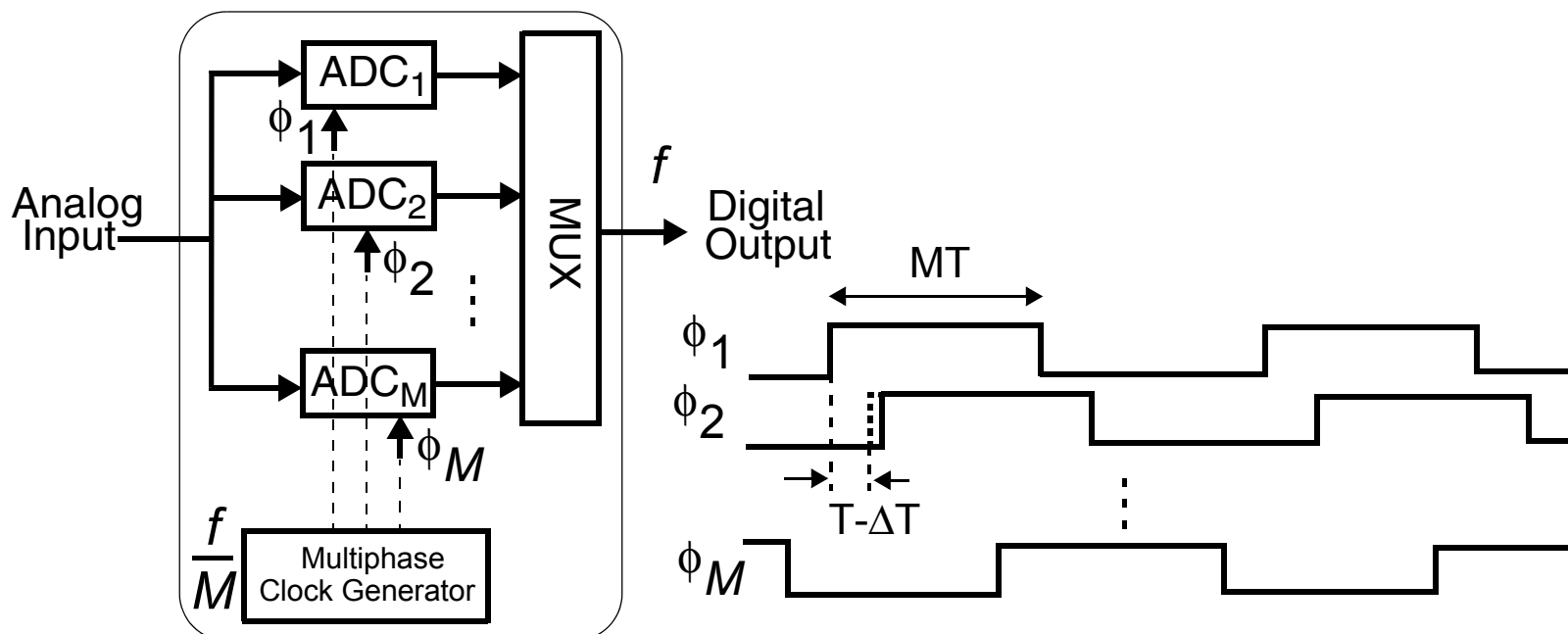

Mismatch Compensation Techniques Using Random Data for Time-Interleaved A/D Converters

Afshin Haftbaradaran and Ken Martin
University of Toronto

Connection 2006



Channel Mismatch in Time-Interleaved ADCs



- There are mismatches (offset, gain and sample-time) among channels.
- All these mismatches happen because of the fabrication process; may change over time due to temperature variation and aging.
- These non-idealities degrade the effective resolution of the ADC.

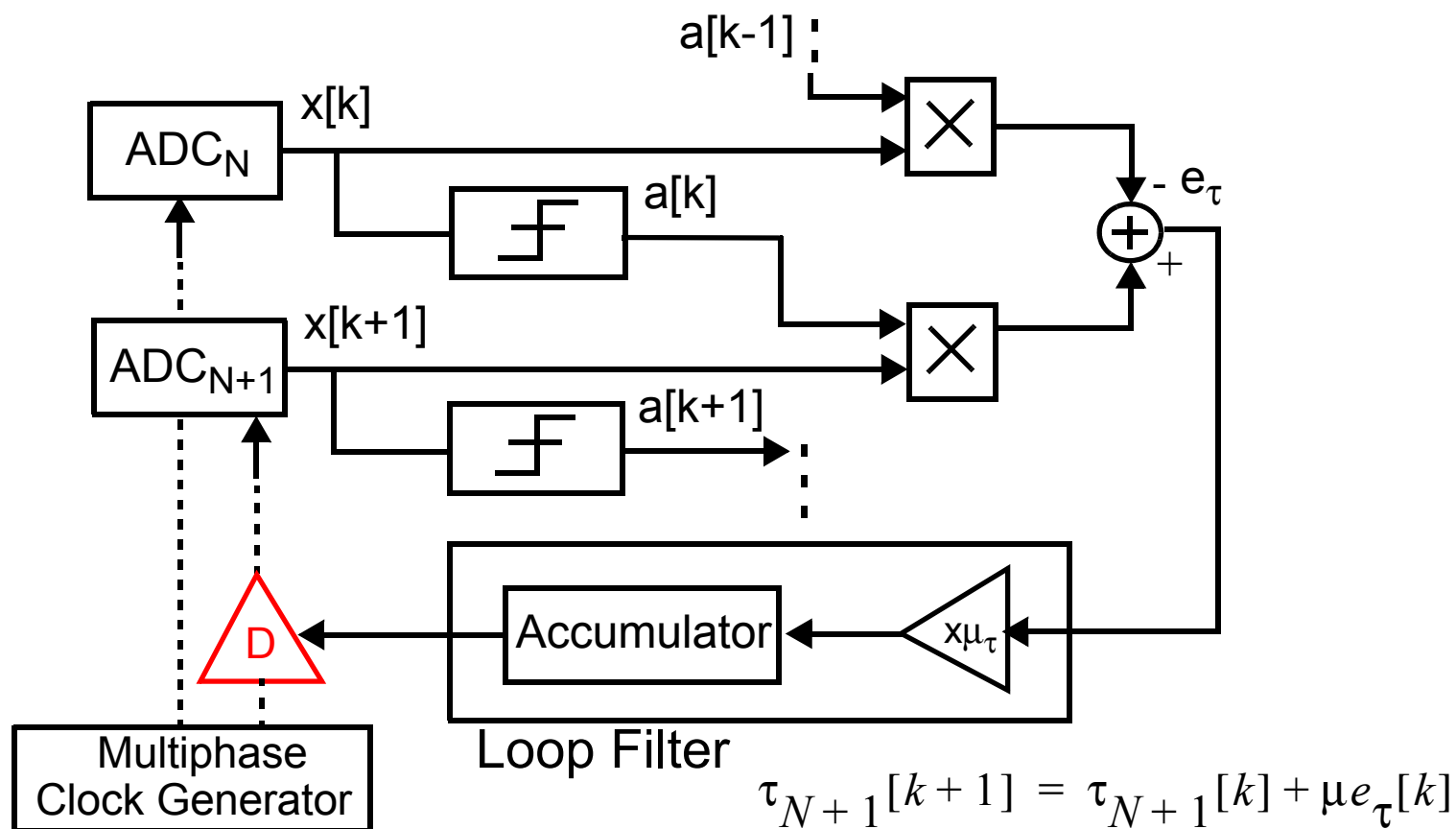


Mismatch Compensation in Time-Interleaved ADCs

- Recently, digital techniques have been proposed for both estimation and correction of these mismatches.
- In this paper, digital and mixed-signal (analog-digital) techniques are proposed in order to compensate for these mismatches:
 - Use random data and do not need any special training signal
 - Do not need oversampling
 - Implementation is inexpensive and practical
 - Especially are suitable for up to moderate resolution ADCs used in digital communication systems



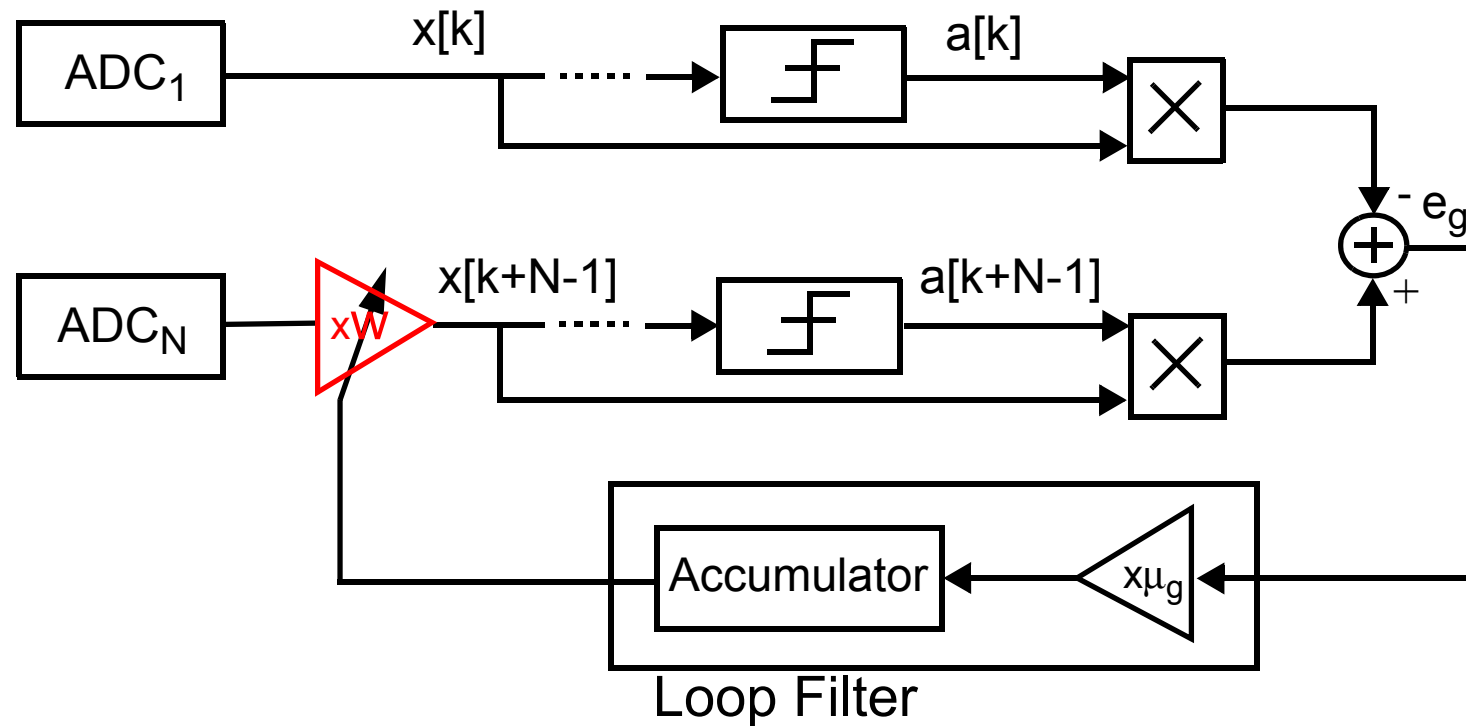
Mixed-Signal Sample-Time Error Compensation Loop



- Block D: A Digitally-Controlled Delay Element.



Gain Mismatch Compensation Loop

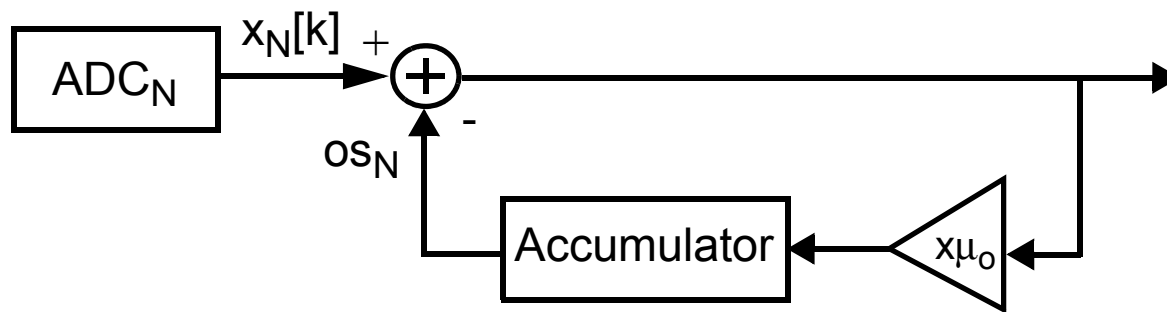


$$g_{N+1}[k+1] = g_{N+1}[k] + \mu e_g[k]$$

- Offset does not affect the estimation, and dependence on sample-time error is weak.



Offset Cancellation Loop



$$E\{x_N[k]\} = OS_N$$



Conclusion

- ✓ Simple digital and mixed-signal algorithms have been proposed to estimate and compensate for the offset, gain and sample-time mismatches in time-Interleaved ADCs.
 - Use random data and do not need any special training signal
 - Do not need oversampling
 - Implementation is inexpensive
 - Can be used as background mismatch compensation methods for ADCs used in digital communication systems
- ✓ These techniques can also be used in calibration process (along with e.g. a PRBS generator, and an analog filter)

