ECE 627: OVERSAMPLED DATA CONVERTERS
SPRING 2024

Lecture times: MWF 3:00 - 3:50 pm, Online.
Lecturer: Gabor C. Temes, KEC 3091, temes@eecs.oregonstate.edu
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Office hours: Online (please send email)
Prerequisite: ECE 626

Textbooks used:
1. Analog Integrated Circuit Design, by D. Johns and K. Martin, Wiley, 1997
or second ed. by T. Carusone, D. Johns and K. Martin, Wiley, 2012. (Required)
2. Data Conversion System Design, by B. Razavi, IEEE Press, 1995 (Optional)
3. Understanding Delta-Sigma Data Converters, by R. Schreier and G.C. Temes, IEEE Press/Wiley, 2004 (Optional)
4. Data Converters, F. Maloberti, Springer 2007 (Optional)
5. Analog-to-Digital Conversion, M. Pelgrom, second ed., Springer, 2013 (optional)

Class website: http://classes.engr.oregonstate.edu/eecs/spring2024/ece627/

Topics discussed:
1. The functions and applications of D/A and A/D converters.
2. Ideal DACs and ADCs: operation, specifications, metrics.
3. Converter nonidealities: offset and gain error, DNL, INL, non-monotonicity, missing codes, SNR, DR, SFDR, etc.
4. DAC architectures: decoder-type, binary, thermometer, hybrid DACs.
5. DAC circuit structures: R-string and R-ladder circuits, current-steering, charge redistribution, hybrid, segmented DACs.
6. ADC architectures: integrating, successive-approximation and algorithmic, pipelined, time-interleaved, sub ranging and two-step, interpolating, folding and flash ADCs.
7. ADC circuits: resistor-string, charge-redistribution, current-steering, hybrid, folding/interpolating circuits.
8. Operational principles of delta-sigma (D-S) DACs and ADCs.
9. Main architectures for the realization of D-S DACs and ADCs.
10. Circuit realization and nonidealities of D-S data converters.

Planned schedule of discussions:
1. Review of data converter operation and characterization (1/2 week)
2. DAC architectures, structures, nonidealities (1 week)
3. ADC architectures, structures, nonidealities (2 weeks)
4. Oversampling data converters (6 weeks)

Midterm Examination: Friday, May 3, 3 - 3:50 pm
Project 1: Due Friday, May 17 (class presentation)

Project 2 (Final project): Due Monday, June 10 (midnight)

Grading: Homeworks:15%, Project 1: 20%, midterm exam 30%, Final Project 35%.