EE 435

Lecture 38

DAC Design
Current Steering DACs

Inherently Insensitive to Nonlinearities in Switches and Resistors
Smaller ON resistance and less phase-shift from clock edges
Current Steering DACs

Transistor Implementation of Switches

\[ \beta = \frac{R_{\text{CELL}}}{R_{\text{CELL}} + kR_F} = \frac{R_{\text{CELL}}}{R_{\text{CELL}} + kR_F} \]

If \( V_{\text{OUTFS}} = V_{\text{REF}} \)

\[ R_{\text{CELL}} = NR_F \]

\[ 0.5 < \beta \leq 1 \]
Current Steering DACs

\[ R \]

\[ d_k \rightarrow I_1 \]

\[ C_P \]

\[ \beta \text{ Compensation} \]

\[ \text{C}_P \text{ Compensation} \]

\[ \text{Differential Output} \]
Current Steering DACs

Binary-Weighted Resistor Arrays
Current Steering DACs

Binary-Weighted Resistor Arrays

Actual layout of resistors is very important
Current Steering DACs

Segmented Resistor Arrays

Binary to Thermometer

Thermometer Coded Array

Binary Coded Array

$V_{REF}$

$X_{MSB}$

$X_{LSB}$

$R_F$

$V_{OUT}$

Segmented Resistor Arrays
R-2R Resistor Arrays

![Diagram of R-2R Resistor Arrays]
Current Steering DACs

R-2R Resistor Arrays
Current Steering DACs

R-2R Resistor Arrays
Another R-2R DAC

\[ V_{\text{OUT}} \]

\[ V_{\text{REF}} \]
Another R-2R DAC
Another R-2R DAC
End of Lecture 38