OpAmps and OTAs

OpAmp

- High voltage gain, high input impedance
- Voltage source output (low impedance)

OTA

- High “voltage” gain, high input impedance
- Current source output (high impedance)

Resistive Feedback

- Open-loop gain: $\infty$
- (Independent of $R_f$)

Capacitive Feedback cont’d

- Charge on $v_x$ is undefined – needs to be reset to known value
- Can we just do this once at start-up?
- Usually do this “reset” every cycle
- Why each cycle instead of only once every N cycles?

Switched-Capacitor Gain Stage

- Many possible topologies – one example shown here
- Clocks generally non-overlapping
SC Gain Stage Phases

- Phase 1:

- Phase 2:

\[ \frac{V_o}{V_i} = \]

Opamp vs. OTA Noise

\[ V_{n,op} = \frac{4kT}{g_{m}} \]

\[ V_{n,ot} = \frac{4kT}{g_{m}} \]

Opamp vs. OTA Revisited

\[ = \]

Opamp

OTA (CS amp)

Buffer (SF)