Noise in op-amps

Recall Johnson noise

\[ \frac{1}{\sqrt{3}} \frac{1}{R} \]

\[ (\sigma_n)_{\text{rms}} = \sqrt{4k_B T R B} \]

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Noise terms:
Ex.

E.g. LF356

$e_n \sim 12 \text{nV}/\sqrt{\text{Hz}}$

$i_{in} \sim 0.01 \text{pA}/\sqrt{\text{Hz}}$

$R_I = 1 \text{k}\Omega$

$R_F = 100 \text{k}\Omega$

$R_S = 5 \text{k}\Omega$
II Interference

- noise due to sources ______ to the circuit

- Sources

- Coupling mechanisms
  1. Mechanical
  2. Capacitive coupling

- any two conductors connected by ________
  have capacitance b/w them
To reduce