Noise and Feedback

• Ideal feedback:
  • Alters bandwidth
  • No decrease of SNR

• Practical feedback: increased noise
  • Noise from feedback network
  • Noise gain from elements outside feedback loop
Ideal Feedback: Input-Referred Noise

Ideal Feedback: Output-Referred Noise
“Real” Feedback Example

- Ignoring noise from $R_1$, $R_2$:

- “Ideal” feedback, why is $v_{i,eq}^2 > v_n^2$?

Source Impedance
Practical Feedback Analysis

- Quick approximation method:
  - Consider loading of feedback network on the input
  - Add a noise source associated with this element.
- Example: shunt feedback
  - Loading at input is $R_F \Rightarrow i_i^2 = i_n^2 + 4kT\Delta f/R_F$

Example #2: Series-Shunt Feedback

- Loading is $R_F||R_E$
- So, noise voltage becomes:
  - $v_i^2 = v_n^2 + 4kT(R_F||R_E)\Delta f$
Example

Example