Training ASMPT

Program session 2

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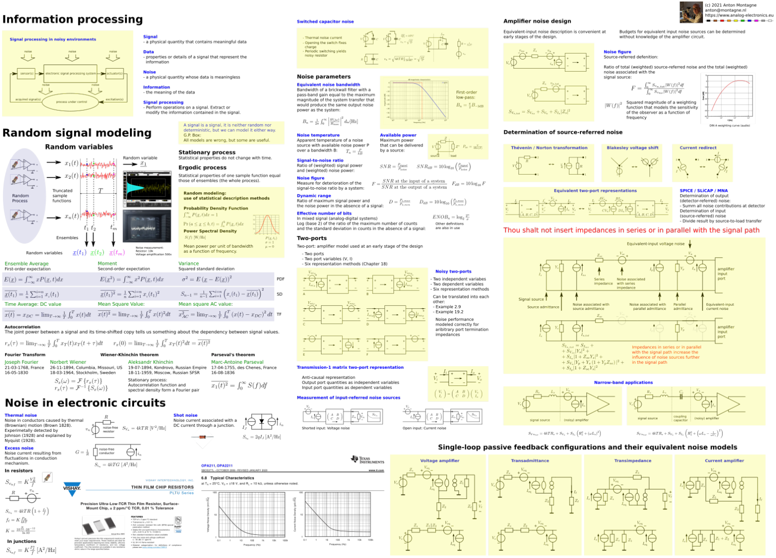
Program session 2

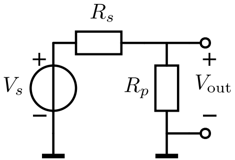
1. Q & A
2. Poster session: noise
3. Examples: Budgeting of noise (hand calculations)
4. Examples: Budgeting and verification of noise (SLiCAP and LTspice)
5. Discussion ASMPT product specification
6. Homework:
    1. Exercises similar as examples
    2. Book chapter 2 and 7

Poster presentation



Example 1

Noise Figure

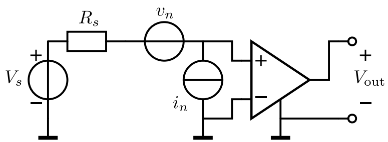


A signal (voltage) source with a source impedance R_s is terminated with a resisor with resistance R_p.

1. Give an expression for the noise figure for this arrangement.
2. Does such termination increase or decrease the total output voltage noise?
3. Verify your answer with SLiCAP.
4. Use LTspice for numerical verification with $R_s = 600\Omega$ and $R_p = 1\mathrm{k}\Omega$.

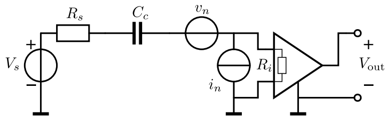
Example 2

Noise Figure



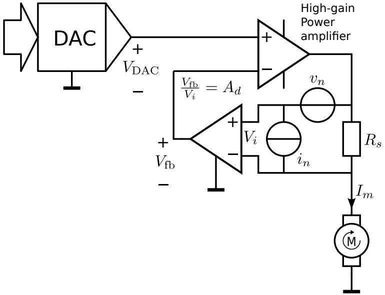
A signal (voltage) source with a source impedance R_s is connected to an amplifier. The noise performance of this amplifier is modeled with its input-referred noise v_n (voltage noise) and i_n (current noise) with spectral densities $S_{v_n}\left[\frac{\mathrm{V}^2}{\mathrm{Hz}}\right]$ and $S_{i_n}\left[\frac{\mathrm{A}^2}{\mathrm{Hz}}\right]$, respectively.

1. Give an expression for the noise figure for this arrangement.
2. Verify your answer with SLiCAP.
3. Use LTspice for numerical verification with $R_s = 600\Omega$, $\sqrt{S_{v_n}} = 2\frac{\mathrm{nV}}{\sqrt{\mathrm{Hz}}}$ and $\sqrt{S_{i_n}} = 3\frac{\mathrm{pA}}{\sqrt{\mathrm{Hz}}}$.



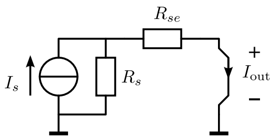
A coupling capacitor is used to connect a signal (voltage) source with a source impedance of 600Ω to an amplifier. The input resistance of the amplifier is $100\mathrm{k}\Omega$. The noise performance of the amplifier is modeled with its input-referred noise v_n (voltage noise) and i_n (current noise) with spectral densities $\sqrt{S_{v_n}} = 2\frac{\mathrm{nV}}{\sqrt{\mathrm{Hz}}}$ and $\sqrt{S_{i_n}} = 3\frac{\mathrm{pA}}{\sqrt{\mathrm{Hz}}}$, respectively.

1. Propose a value for the coupling capacitance if this arrangement should have a low-noise transfer from 10Hz to 100kHz.



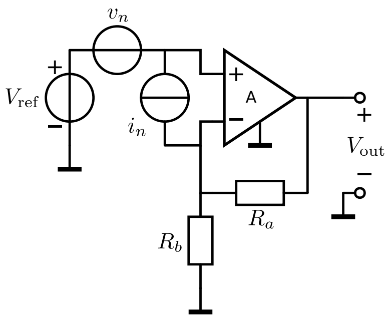
A current driver consists of a high-gain, low-noise, high-power voltage amplifier with output current feedback.
A current sense resitor with resistance R_s converts the output current into a voltage. This voltage is amplified by a differential voltage amplifier and compared with the setpoint provided by a DAC. The noise performance of the differential amplifier is modeled with its input-referred noise v_n (voltage noise) and i_n (current noise) with spectral densities $S_{v_n}\left[\frac{\mathrm{V}^2}{\mathrm{Hz}}\right]$ and $S_{i_n}\left[\frac{\mathrm{A}^2}{\mathrm{Hz}}\right]$, respectively.

1. Give an expression for motor current noise of this arrangement.
2. Verify your answer with SLiCAP.



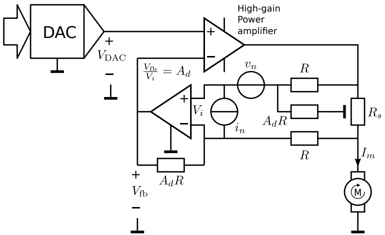
A resistor with resistance R_{se} is paced in series with a signal (current) source with a source impedance R_s.

1. Give an expression for the noise figure for this arrangement.
2. Does such termination increase or decrease the total output current noise?
3. Verify your answer with SLiCAP.
4. Use LTspice for numerical verification with $R_se = 600\Omega$ and $R_s = 1\text{k}\Omega$.



A signal (voltage) source with a source impedance R_s is connected to an amplifier.A low-noise regulator consists of a low noise voltage reference and a power amplifier. The output voltage can be adjusted with a resistive divider. The noise performance of the power amplifier is modeled with its input-referred noise v_n (voltage noise) and i_n (current noise) with spectral densities S_{v_n} $\left[\frac{\mathrm{V}^2}{\mathrm{Hz}}\right]$ and S_{i_n} $\left[\frac{\mathrm{A}^2}{\mathrm{Hz}}\right]$, respectively.

1. Give an expression for the output voltage noise of this arrangement.
2. Verify your answer with SLiCAP.
3. Propose a method to obtain a low output noise, independent of the values of the feedback resistors.



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1. Give an expression for motor current noise of this arrangement.
2. Verify your answer with SLiCAP.
3. Propose a method to reduce the contribution of the resistors of the differential amplifier to the motor noise current.

Next Week

Preliminary program

1. Q & A (Homework)
2. Poster session: Modeling and characterization of the ideal behavior of amplifiers and design of negative feedback amplifier configurations.
3. Modeling and characterization of port isolation errors
4. Modeling and characterization of inaccuracy and nonlinearity
5. Poster session: Modeling and characterization of dynamic behavior / Estimation of poles and zeros
6. Modeling and characterization of operational amplifiers
7. Guided Exercise: Modeling of individual performance apsects of OpAmps