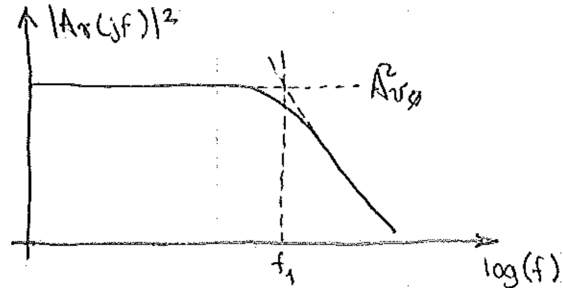
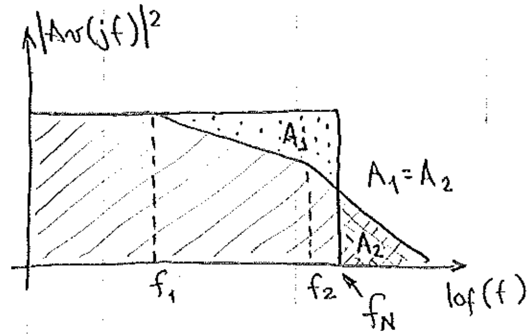
Noise Bandwidth

- The total noise corrupting a signal in a circuit results from all of the frequency components falling in the circuit BW.
- Not all circuits have a simple gain frequency characteristic
- Consider a multipole circuit with a frequency response:



Simple gain-frequency characteristic



In this case the noise component above f_1 cannot be neglected and the total output noise needs to be computed as:

$$\overline{v_{oT}^2} = \int_0^\infty S_o(f)\,df = \int_0^\infty |A_v(jf)|^2 S_i(f)\,df \quad (1)$$

If we consider the EIG to have a white spectrum, i.e.

$$S_i(f) = S_{i\varnothing} \leftarrow \text{constant}$$

Then $$\overline{v_{oT}^2} = S_{i\varnothing}\int_0^\infty |A_v(jf)|^2\,df \quad (2)$$

This integral grows in complexity as the circuit complexity increases.

If consider the response of an equivalent circuit whose transfer function shows a sharp edge at f_N and with low-frequency gain $A_{v\varnothing}$, and f_N computed such that $\overline{v_{of_N}^2} = \overline{v_{oT}^2}$, then we can write

$$\overline{v_{oT}^2} = S_{i\varnothing} A_{vo} f_N \quad (3)$$

and therefore $$f_N = \frac{1}{A_{vo}^2}\int_0^\infty |A_v(jf)|^2\,df \quad (4)$$

f_N is the equivalent noise bandwidth of the circuit