Sensitivity and vector margin

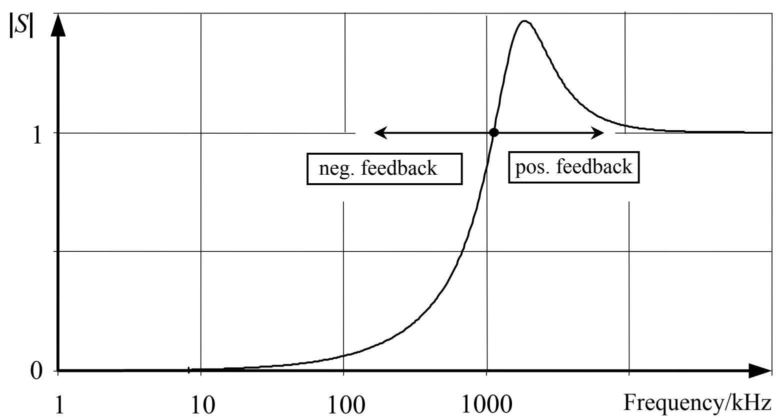
With the loop gain function L_0 and the denominator of the closed loop transfer function we can define the „sensitivity figure“ S as follows:

$$\frac{1}{\left|1-\underline{L}_0(\mathrm{j}\omega)\right|}=\left|\underline{S}(\mathrm{j}\omega)\right|<1 \quad \Rightarrow neg.feedback \ ,$$

$$\frac{1}{\left|1-\underline{L}_0(\mathrm{j}\omega)\right|}=\left|\underline{S}(\mathrm{j}\omega)\right|>1 \quad \Rightarrow pos.feedback \ .$$

Using this definition it is easy to discriminate between pos. and neg. feedback.

Example (see the figure)
Opamp with $A_{0,\max}=100$ dB and two poles at 16 Hz and 1,6 MHz and with unity gain feedback.



Transition from negative to positive feedback: f=1,1 MHz.
At 1,8 MHz we have $|S|_{\max}\approx 1{,}45$ – equivalent to a vector margin of app. 1/1,45≈0,7.
(The expression $1/|\underline{S}(\mathrm{j}\omega)|_{\max}$ is identical to the minimum distance between the Nyquist curve $\underline{L}_0(\mathrm{j}\omega)$ and the critical point „+1“ in the complex plane and is called „vector margin“)