EE 508

Laboratory 5

Fall 2024

It has been observed that the integrator is a key building block for many filter structures. As such, the performance of the integrator plays a key role in the performance of filters employing the integrator. There have been numerous integrator architectures proposed and some are better than others. A metric for characterizing the performance of the integrators is useful for predicting how a given integrator structure will perform. One of the most important characteristics of an integrator is that is have precisely a -90° phase shift at the nominal unity gain frequency. Since the gain of a nonideal integrator is frequency dependent, it can be expressed as

$$I(s)=\frac{1}{R(s)+jX(s)}$$

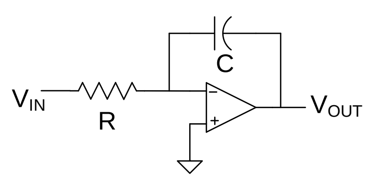
Since the phase shift of an ideal integrator is ideally -90°, a figure of merit for the performance of an integrator, defined as the integrator Q-factor, is often used. This is defined as

$$Q_{INT}=\frac{X(j\omega)}{R(j\omega)}$$

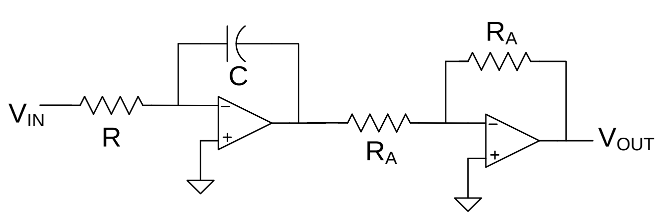
Ideally $Q_{INT}=\infty$ for all ω.

For this lab,

a) Compute Q_{INT} due to nonideal effects of the operational amplifiers (A(s)=GB/s) for the basic Miller inverting and noninverting integratokrs shown below.
b) Develop a method and use it to experimentally measure Q_{INT} at the ideal unity gain frequency for the Miller Inverting Integrator for unity gain frequencies of 10KHz, 50KHz, and 100KHz using an operational amplifier of your choice.



Inverting Miller Integrator



Noninverting Miller Integrator