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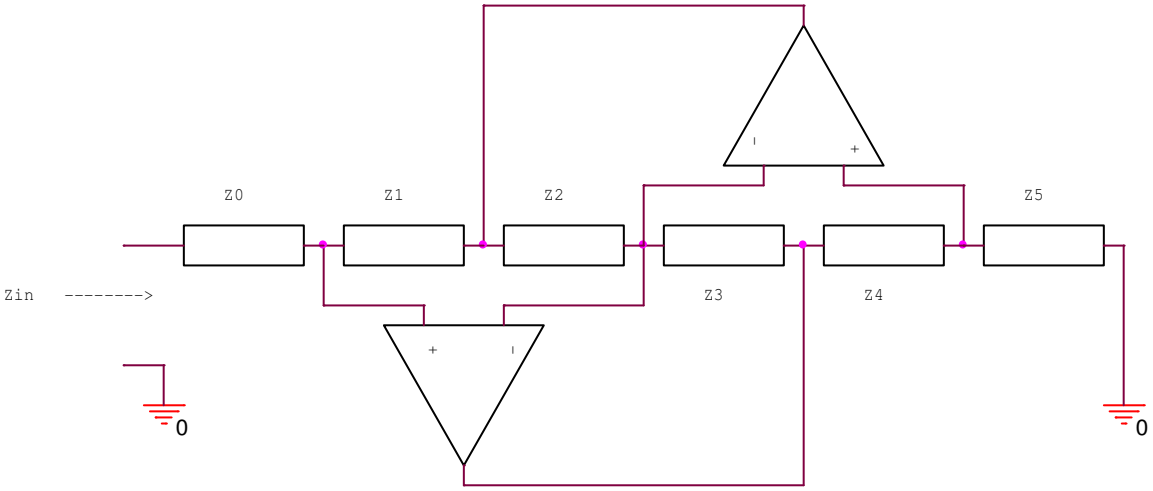
610 Fall 2008 – Homework 3

1. The following circuit is called a GIC (=General Impedance Converter). When the op-amps are ideal, it is known that (where all Z's are impedances)

$$Zin = Z0+(Z1\cdot Z3\cdot Z5)/(Z2\cdot Z4)$$

a) Show this to be the case.
b) Let Z0=Z1=Z2=Z4=R, Z3=Z5=sC. Give Zin(s) and evaluate for s=jω. Comment on a possible meaning of this.
c) Repeat b) with Z0=0, Z1=Z2=Z5=R, Z2=Z4=sC.
d) Find Zin in terms of Z0 through Z5 when the op-amps have a (constant) voltage gain, K, and zero input currents. Evaluate in the situations of c) and d) above.



2. Consider that the above circuit is made into a 2-port by replacing Z5 by the second port. Find the 2-port admittance matrix and check that when it is loaded by Z5 the formula given above for Zin holds. Discuss existence of the 2-port Z matrix.
3. It is conjectured that this can be made into a gyrator by an appropriate placing of the second port and choice of the Z's. Check if this is possible and if not decide if anything can be done to simply modify the circuit to make it possible..