

610 Fall 2011 – Homework 1 Due Tu 09/13/11

This problem uses the current to voltage converter of Figure 2 of the design idea of Maciej Kokot, “Measure small currents without adding resistive insertion loss,” EDN, Issue 14, July 28, 2011, pp. 52 & 54.

1. [50 points] [Spice runs]

Insert the circuit of Figure 2 to find the resistor current in a circuit comprising a DC voltage source of 1V with a 1kOhm resistor across it (call it R5 for problem 2). Set this up in PSpice using 741 Op-Amps (bias at +/-10V). Check if Spice gives the correct current. Then do a parametric run by varying the source voltage from -10V to +10V in 5V steps. Comment upon the results.

2. [50 points] [circuit graph & matrices]

Assume that the Op-Amps are ideal represented by nullors. Draw an oriented graph for the circuit of problem 1. Number resistor branches with the numbers of the resistors in Figure 2 (include the voltage source in the branch of R5); for the Op-Amps use 2 branches using lower numbering for the top Op-Amp and left branches. Orient branches down or to the right (the uniformity of numbering and orientation is for ease of grading).

Give the cut-set and tie set matrices and, using literal circuit element values, an $AV=BI$ description in as close to admittance description as possible. Use these to check if $V_o = I(R_1+R_2)$.