Helpful Readings for this Homework: Agarwal & Lang Chapter 7.1 - 7.6

Exercise 5.1: Do Exercise 7.1 in Agarwal & Lang, page 390.

Exercise 5.2: Do Exercise 7.3 in Agarwal & Lang, page 391.

Problem 5.1: Determine the Thevenin equivalent of the following circuit. Note that it contains a dependent voltage source, and that the parameter $\alpha$ has units of Ohms.

![Figure for Problem 5.1](image)

Problem 5.2: This problem studies the two amplifiers shown on the other side of the page. Amplifier A is a single-stage amplifier implemented with a voltage-dependent current source and a pull-up resistor. Assume that the current source parameters $G$ and $V_T$ satisfy $G > 0$ and $V_S > V_T > 0$. Also assume that $\frac{RG}{V_S - V_T}$. Amplifier B is a two-stage amplifier in which each stage is identical to Amplifier A.

(A) Determine $v_{OUT}$ as a function of $v_{IN}$ for Amplifier A.

(B) Sketch and clearly label a graph of the input-output relation found in Part (A).

(C) Determine $v_{OUT}$ as a function of $v_{IN}$ for Amplifier B.

(D) Sketch and clearly label a graph of the input-output relation found in Part (C).

(E) Consider Amplifier A again. Show that the dependent current source sinks power for $v_{OUT} > 0$ and sources power for $v_{OUT} < 0$.

(F) Unlike the expression for the current in Amplifier A given with the figure on the next page, real-world devices do not supply additional current when $v_{OUT} < 0$. Instead the device saturates and the dependent current source supplies a constant current, given by $V_S / R$. Redo parts (A) and (B) in light of this fact. What change (if any) occurs in the input-output relation of Amplifier B?
Figure for P.5.2.