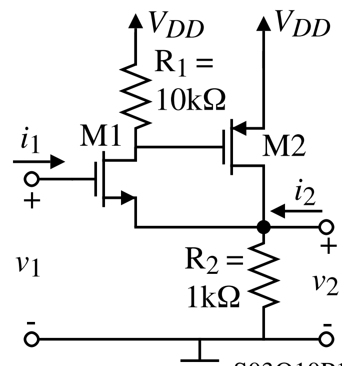
QUIZ NO. 10 - SOLUTION

(Average Score = 6.7/10 of those who took the quiz)

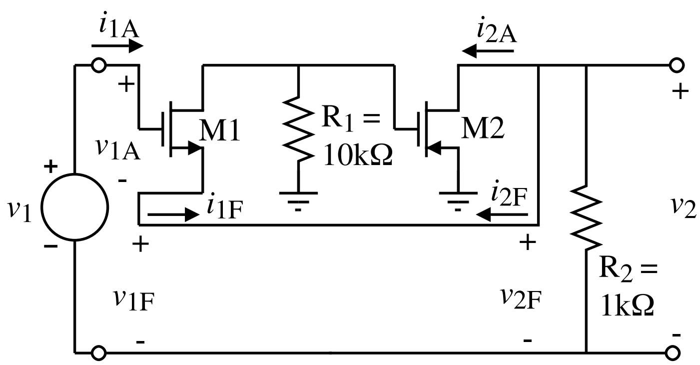
A series-shunt feedback amplifier is shown. Use the methods of feedback analysis to find the numerical values of v_2/v_1, v_1/i_1, and v_2/i_2. Assume that all transistors are matched and that g_m = 1mS and $r_{ds} = \infty$.



S03Q10P1

Solution

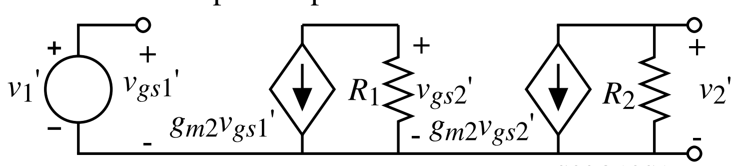
The circuit can redrawn as shown to identify more clearly the A circuit and the feedback circuit.



S03Q10S1A

$$\beta = h_{12F} = \frac{v_{1F}}{v_{2F}}\bigg|_{i_{1F}=0} = 1\text{(V/V)}$$

The small-signal model for the open-loop calculation of *A*.



S03Q10S1B

$$A\Big|_{\beta=0} = \frac{v_2'}{v_1'} = \left(\frac{v_2'}{v_{gs2}'}\right)\left(\frac{v_{gs2}'}{v_{gs1}'}\right)\left(\frac{v_{gs1}'}{v_1'}\right) = (-g_{m2}R_2)(-g_{m1}R_1)(1)$$

$$= (-10)(-1)(1) = 10 \text{ V/V}$$

$$A_F = \frac{v_2}{v_1} = \frac{A}{1+A\beta} = \frac{10}{1+10\ (1)} = \frac{10}{11} = \underline{\underline{0.909 \text{ V/V}}}$$

Because $h_{11T} = \infty$, $R_{in} = v_1/i_1 = \underline{\underline{\infty}}$

The open-loop output resistance is,

$$R_o = R_2 = 1000\Omega$$

$$\therefore\ R_{out} = \frac{v_2}{i_2} = \frac{R_o}{1+A\beta} = \frac{1000\Omega}{11} = \underline{\underline{91\ \Omega}}$$