

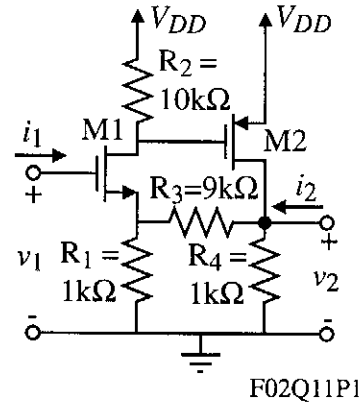
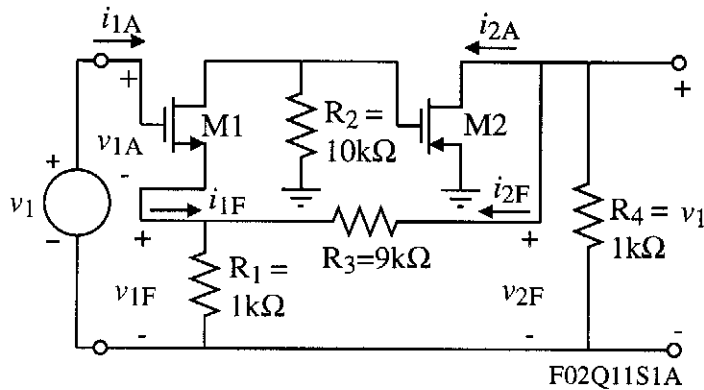
QUIZ NO. 11 - SOLUTION

(Average Score = 6.8/10 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 $g_m = 1\text{mS}$ and $r_{ds} = \infty$.

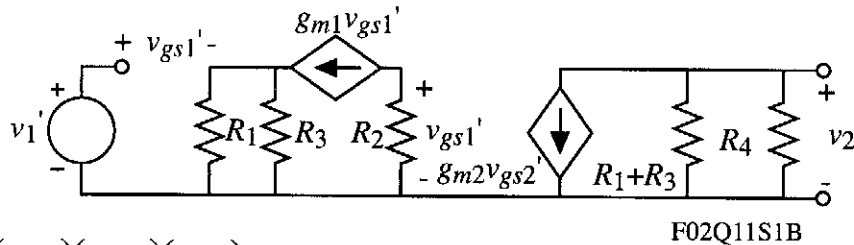
Solution

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



$$\beta = h_{12F} = \frac{v_{1F}}{v_{2F}} \Big|_{i_{1F}=0} = 0.1(\text{V/V})$$

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



$$A = \frac{v_2'}{v_1'} = \left(\frac{v_2'}{v_{gs2'}} \right) \left(\frac{v_{gs2'}}{v_{gs1'}} \right) \left(\frac{v_{gs1'}}{v_1'} \right) = [-g_{m2}(R_4 \parallel R_1 + R_3)](-g_{m1}R_2) \left(\frac{1}{1 + g_{m1}(R_1 \parallel R_3)} \right)$$

$$= (-0.909)(-10) \left(\frac{1}{1 + 0.9} \right) = 4.785 \text{ V/V}$$

$$A_F = \frac{v_2}{v_1} = \frac{A}{1 + A\beta} = \frac{4.785}{1 + 4.785(0.1)} = \frac{4.785}{1.4785} = \underline{3.236 \text{ V/V}}$$

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

The open-loop output resistance is ,

$$R_o = R_4 \parallel (R_1 + R_3) = 909\Omega$$

$$\therefore R_{out} = \frac{v_2}{i_2} = \frac{R_o}{1 + A\beta} = \frac{909\Omega}{1.4785} = \underline{614\Omega}$$