

Control Systems

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CONTENTS

Abstract—This manual is an introduction to control systems in feedback circuits. Links to sample Python codes are available in the text.

Download python codes using

svn co <https://github.com/gadepall/school/trunk/control/feedback/codes>

1 FEEDBACK VOLTAGE AMPLIFIER: SERIES-SHUNT

2 FEEDBACK CURRENT AMPLIFIER: SHUNT-SERIES

2.1 Ideal Case

2.1. The feedback current amplifier in fig.?? can be thought of as a “super” CG transistor. Note that rather than connecting the gate of Q_2 to signal ground, an amplifier is placed between source and gate.

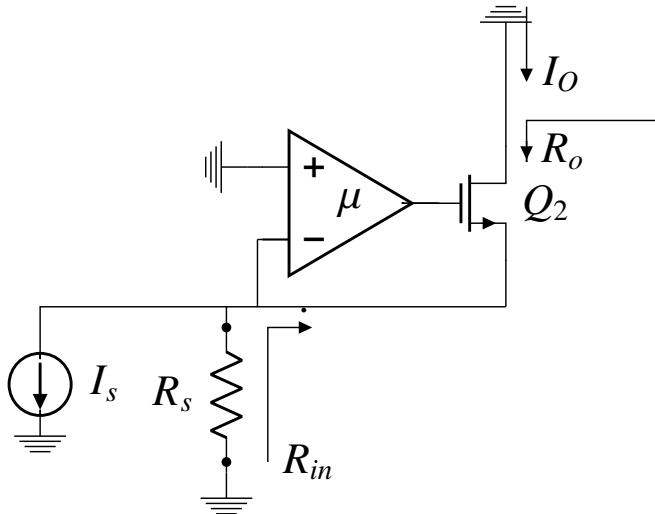


Fig. 2.1

for the fig.?? , the parameter's table is TABLE.??

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Parameter	Value
input resistance(large μ)	0
output resistance(large μ)	∞
Input voltage	$-I_s R_s$
input resistance(finite μ)	R_s
output resistance(finite μ)	r_o
source resistance	R_s
feedback factor H	1
Open Loop Gain, G	$\mu g_m R_s$ A/A
Closed Loop Gain, T	1 A/A

TABLE 2.1

2.2. (a) If μ is very large, what is the signal voltage at the input terminal? What is the input resistance? What is the current gain I_o/I_s ?

Solution:

Refer to the fig. ?? for the feedback current amplifier circuit, in this super common gate transistor is connected between the gate and source terminals of the MOSFET.

Replace the op-amp with its equivalent modal and replace the MOSFET with its small signal equivalent circuit.

with reference to the fig.?? . For ideal op-amp, the input resistance(R_{id}) is very high (infinite) . And the drain current is approximately equal to source current

$$I_D \cong I_s \quad (2.2.1)$$

The closed loop gain of op-amp is

$$T = \frac{\mu}{1 + \mu H} \quad (2.2.2)$$

for larger value of closed loop gain , open loop gain ' μ ' will be large. from fig.?? we can observe that input voltage is,

$$V_{in} = -R_s I_s \quad (2.2.3)$$

Since the drain current is approximately is equal to source current, And the current flowing through resistor R_s is I_s since there is no current flowing through the negative terminal