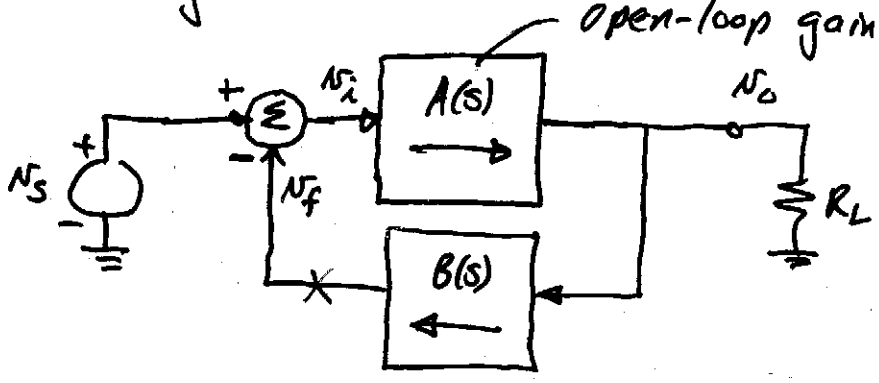
CHAPTER 18 – FEEDBACK CONCEPTS AND THEORY

(Feedback is a great concept but a terrible analysis tool.)

Classical Single Feedback (Negative)

Block diagram –



$$V_o = A(s)V_i = A(s)\left[V_s - V_f\right] = A(s)V_s - A(s)B(s)V_o$$

$$V_o\left[1 + A(s)B(s)\right] = A(s)V_s$$

$$\text{Closed-loop transfer function} = \frac{V_o}{V_s} = \frac{A(s)}{1 + A(s)B(s)} = \frac{A(s)}{1 - T(s)}$$

$T(s)$ = Loop gain $= -A(s)B(s)$ $\quad |T(s)| = A(s)B(s)$

Jaeger: $\dfrac{V_o}{V_s} = \dfrac{A(s)}{1 + T(s)} \rightarrow T(s) = A(s)B(s)$

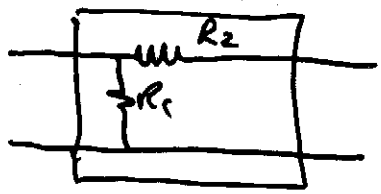
KEY: If the magnitude of the loop gain $>> 1$

then $\dfrac{V_o}{V_s} = \dfrac{A(s)}{1 + \underbrace{A(s)B(s)}_{\text{Large} >> 1}} \rightarrow \dfrac{A(s)}{B(s)A(s)} = \dfrac{1}{B(s)}$

$T(s) > 0 \rightarrow +$ FB

$T(s) < 0 \rightarrow -$ FB

$B(s)$:



$$B = \frac{R_1}{R_1 + R_2}$$

$$\text{C.L.G.} \cong \frac{1}{B} = \frac{R_1 + R_2}{R_1}$$

Types of Feedback Circuits –

Input variable: x_s, x_f or x_i

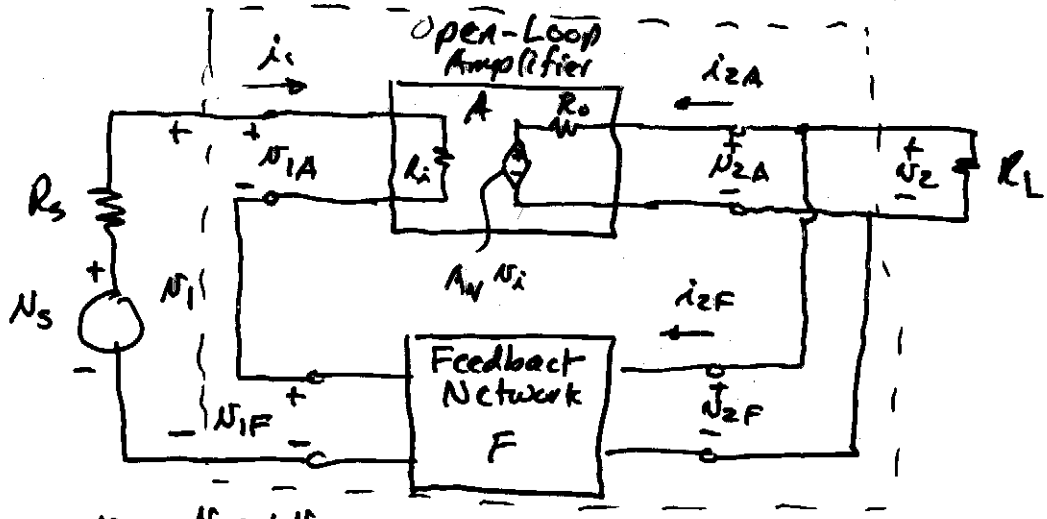
Output variable: x_o

x = voltage or current

x_s, x_f & x_i must be the same type

Input variables: (x_i, x_f, x_s)	Output Varible x_o	Type of Feedback (input-output)
Voltage	Voltage	Series-Shunt
Current	Voltage	Shunt-shunt
Current	Current	Shunt-Series
Voltage	Current	Series-Series

Series-shunt (Voltage Amplifiers)



$v_1 = v_{1A} + v_{1F}$

or $v_{1A} = v_1 - v_{1F}$

$(v_i = v_s - v_f)$