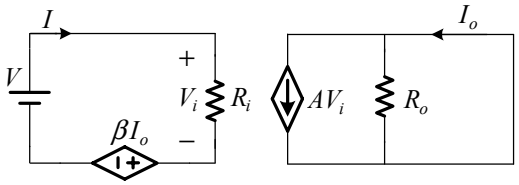
圖10.18爲理想的串串迴授放大器及等效電路

A ：單一方向（由輸入到輸出）傳送的互導放大器

β ：單一方向（由輸出到輸入）傳送的迴授網路

⑴ $A_f = \dfrac{I_o}{V_s} = \dfrac{A}{1+A\beta}$ ……(10.15)

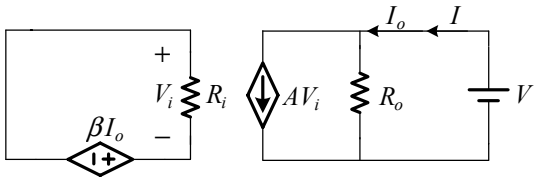
⑵求 R_{if} ：



$$V = V_i + \beta I_o = V_i + \beta(AV_i) = (1+\beta A)V_i$$

$$= (1+\beta A)I \cdot R_i \text{ ， 得 } R_{if} = \frac{V}{I} = R_i \cdot (1+\beta A)$$

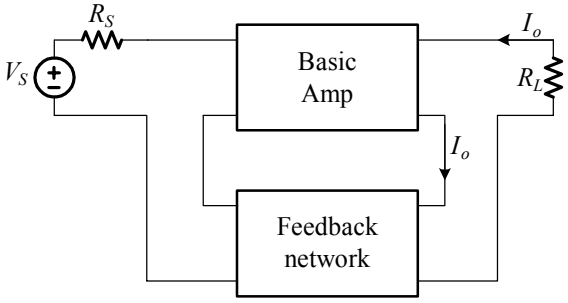
⑶求 R_{of} ：



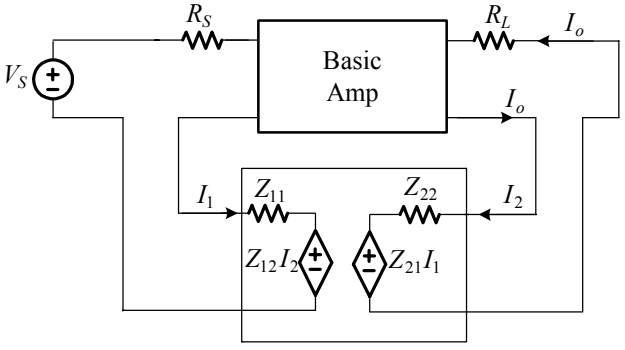
$$I = \frac{V}{R_o} + AV_i = \frac{V}{R_o} + A(-\beta I)$$

$$\Rightarrow (1+\beta A)I = \frac{V}{R_o} \Rightarrow R_{of} = \frac{V}{I} = R_o(1+\beta A)$$

二、實際串串迴授放大器分析

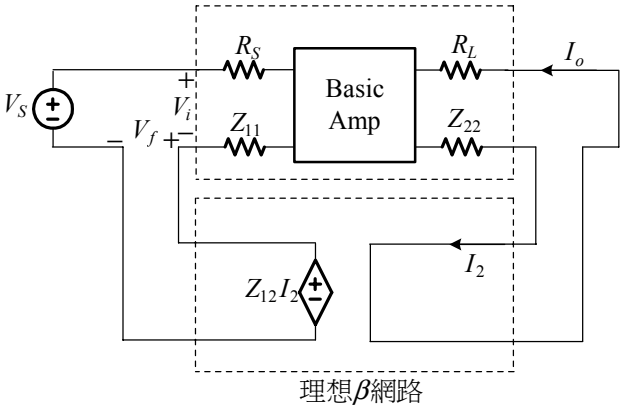


(a)串串迴授方塊圖



實際β網路

(b)以 Z 參數表示 β 網路



理想β網路

(c)轉換成理想模式（忽略 Z_{21}）

圖10.19 實際串串迴授放大器電路圖

【解題方法】

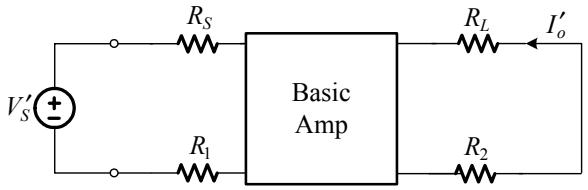
1. 基本放大器 A ：串串迴授

輸入串聯 ⇒ 電壓訊號源

⇒ 將輸入迴路化成戴維寧型式串聯 R_1

輸出串聯 ⇒ 電流輸出、電流取樣迴授

⇒ 將輸出迴路串聯 R_2



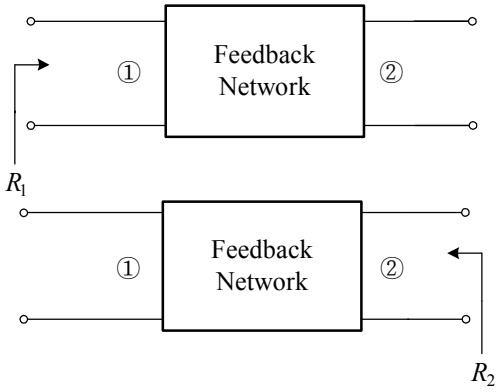
$A = \dfrac{I_o'}{V_s'}$ ～互導增益

2. 決定 R_1 及 R_2 ：

Series ⇒ 開路

求 R_1 ：將②開路，由①看入

求 R_2 ：將①開路，由②看入

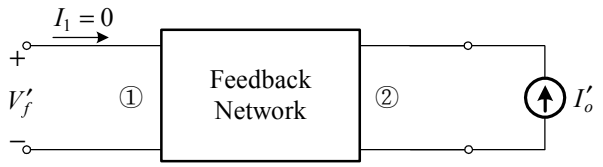


3. 決定 β ：

電流取樣 ⇒ ②端加上電流源 I_o'（與 I_o 同向）

電壓混合 ⇒ ①端開路，量 V_f'

$$\beta = \left.\frac{V_f'}{I_o'}\right|_{I_1=0}$$



4. $A_f = \dfrac{A}{1+\beta A}$ ·····(10.16)

$R_{if} = (1+A\beta)R_i$ ·····(10.17)

$R_{of} = (1+A\beta)R_o$ ·····(10.18)

範題 10

Figure shows a voltage-controlled current-source circuit. It embodies feedback of the current-sampling series-mixing type. However, for practical reasons the current being sampled is not the output current in the collector but rather the almost equal emitter current. We wish to carry out small-signal analysis to determine I_o/V_s, R_{if}', and R_{of}'.