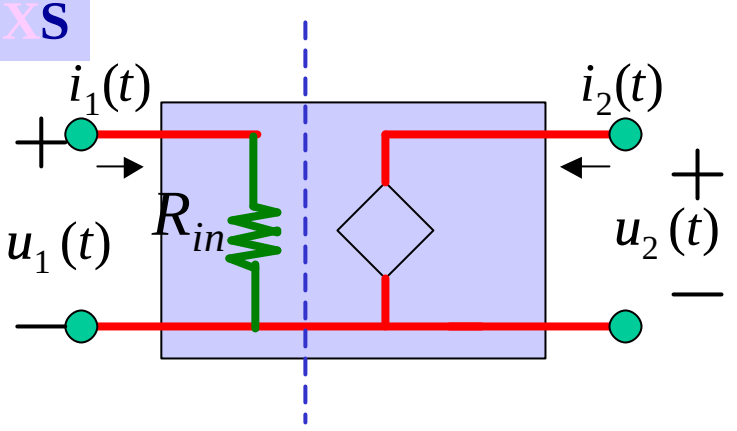
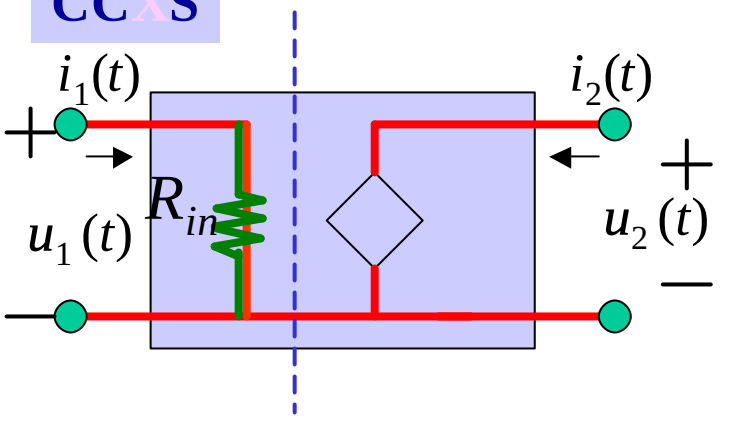
0.6 輸入阻抗與輸出阻抗(Input and Output Impedance)

Input Impedance $R_{in}\ (Z_{in})$ 輸入埠看成是無源線性網路

VCXS

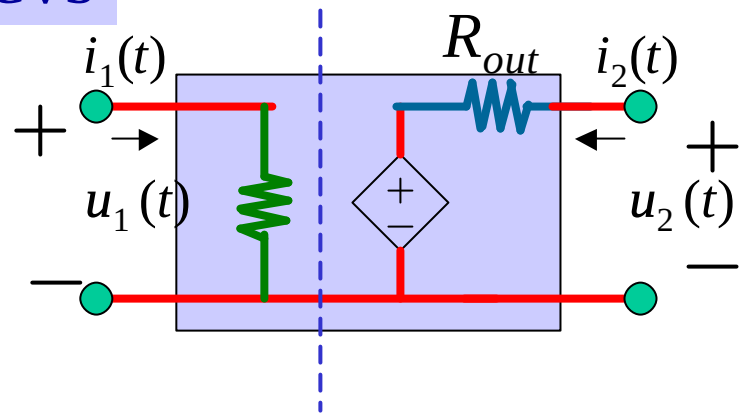


CCXS

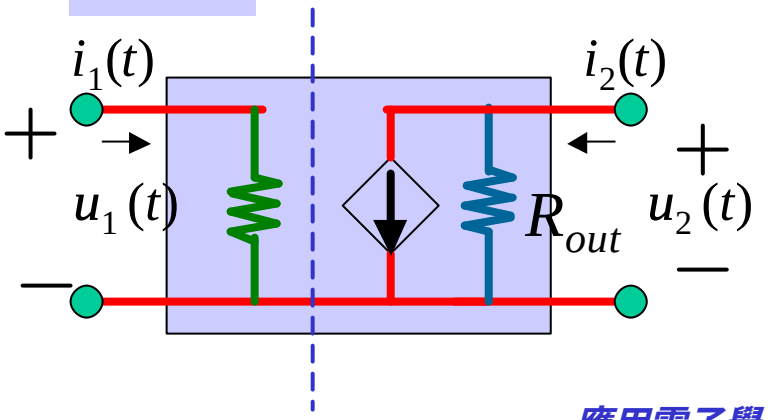


Output Impedance $R_{out}\ (Z_{out})$ 輸出埠看成是“有”源線性網路

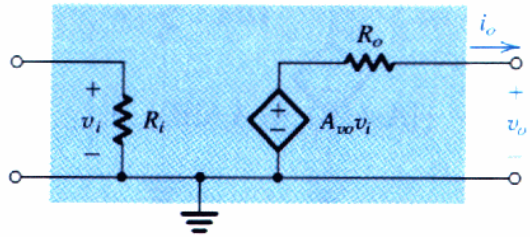
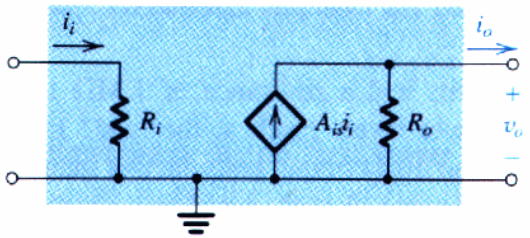
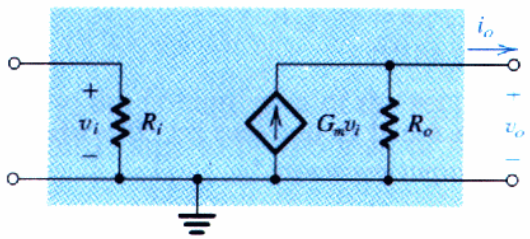
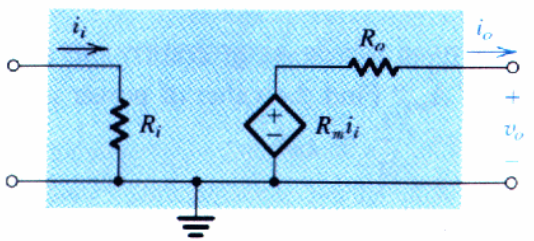
XCVS



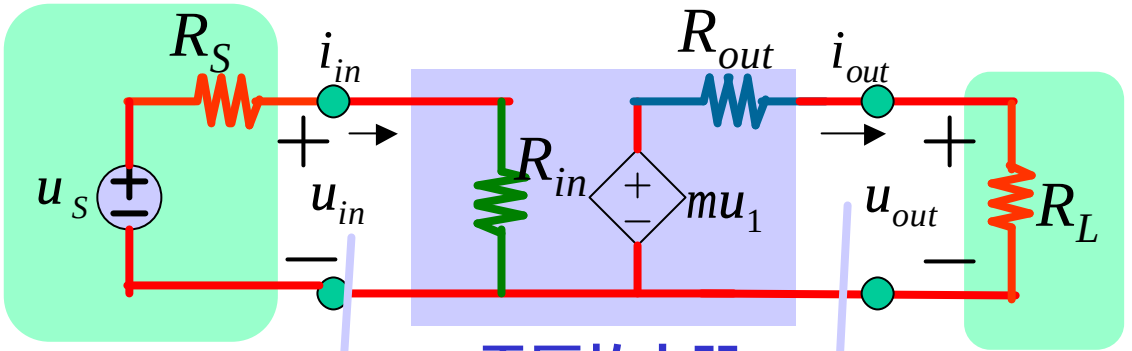
XCCS



THE FOUR AMPLIFIER TYPES

Type	Circuit Model	Gain Parameter	Ideal Characteristics
Voltage Amplifier		Open-Circuit Voltage Gain $A_{vo} \equiv \left.\frac{v_o}{v_i}\right\|_{i_o = 0}$ (V/V)	$R_i = \infty$ $R_o = 0$
Current Amplifier		Short-Circuit Current Gain $A_{is} \equiv \left.\frac{i_o}{i_i}\right\|_{v_o = 0}$ (A/A)	$R_i = 0$ $R_o = \infty$
Transconductance Amplifier		Short-Circuit Transconductance $G_m \equiv \left.\frac{i_o}{v_i}\right\|_{v_o = 0}$ (A/V)	$R_i = \infty$ $R_o = \infty$
Transresistance Amplifier		Open-Circuit Transresistance $R_m \equiv \left.\frac{v_o}{i_i}\right\|_{i_o = 0}$ (V/A)	$R_i = 0$ $R_o = 0$

例題　輸入及輸出阻抗對電壓放大器的影響



$$u_{in} = u_S \frac{R_{in}}{R_S + R_{in}} \qquad u_{out} = m u_{in} \frac{R_L}{R_{out} + R_L}$$

$$A_V = \frac{u_{out}}{u_{in}} = m \frac{R_L}{R_{out} + R_L}$$

沒有考慮訊號源之輸出阻抗
(Source impedance)R_S

$$A_V' = \frac{u_{out}}{u_S} = \frac{u_{in}}{u_S} \cdot \frac{u_{out}}{u_{in}}$$

$$= \frac{R_{in}}{R_S + R_{in}} \cdot \frac{R_L}{R_{out} + R_L}$$

輸入負載效應

$R_{in} \to \infty$

1

輸出負載效應

$R_L \to \infty$

1

設計電壓放大器時，最好要求

$$R_L >> R_{out}$$

$$R_S << R_{in}$$

一般放大器設計時，由訊號源(source)和負載(load)所要的訊號來考慮

Source	R_{in}	R_{out}	**負載訊號**
Voltage	**愈大愈好**	**愈小愈好**	Voltage
Current	**愈小愈好**	**愈大愈好**	Current
Power	**剛剛好**	**剛剛好**	Power

考慮的由訊號源傳送到負載的最大功率，R_{in}要等於Source的輸出阻抗，R_{out}要等於負載阻抗。