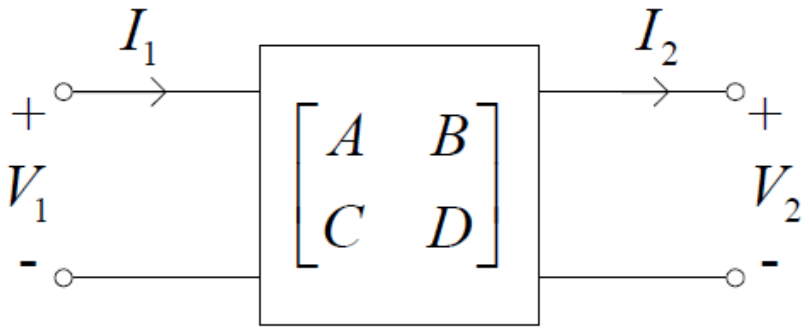
# ABCD Matrisi

# İletim (ABCD) Matrisi

İki uçlu bir devre için



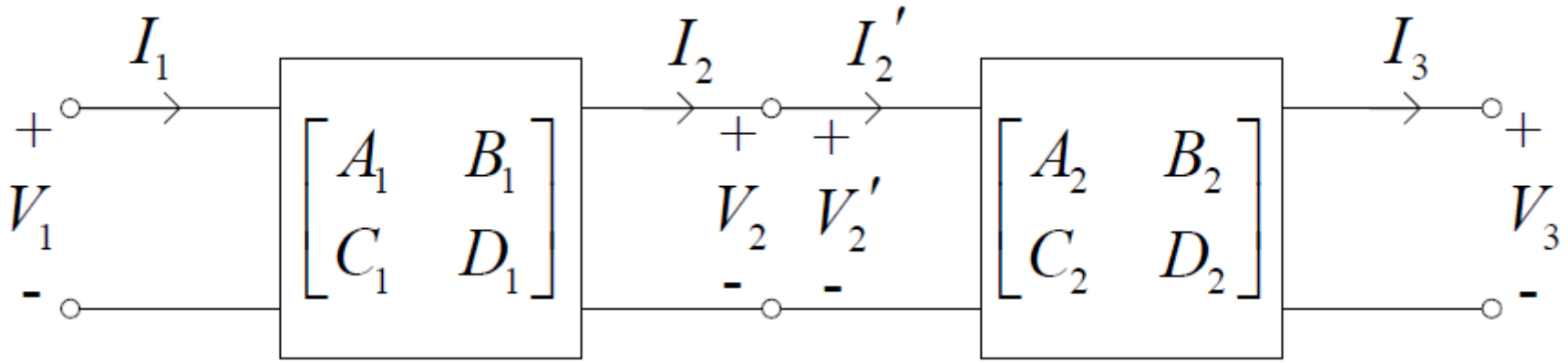

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \cdot \begin{bmatrix} V_2 \\ I_2 \end{bmatrix}$$

$$A = \left.\frac{V_1}{V_2}\right|_{I_2=0}, \quad B = \left.\frac{V_1}{I_2}\right|_{V_2=0}$$

$$C = \left.\frac{I_1}{V_2}\right|_{I_2=0}, \quad D = \left.\frac{I_1}{I_2}\right|_{V_2=0}$$

# ABCD Matrisi

Ardışıl bağlı devre analizinde çok kullanışlıdır

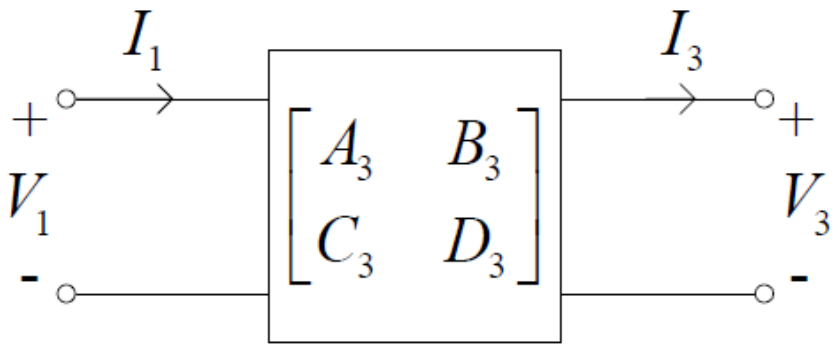



$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} \cdot \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix} \cdot \begin{bmatrix} V_3 \\ I_3 \end{bmatrix}$$

# ABCD Matrisi

$$\begin{bmatrix} A_3 & B_3 \\ C_3 & D_3 \end{bmatrix} = \begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} \cdot \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix}$$

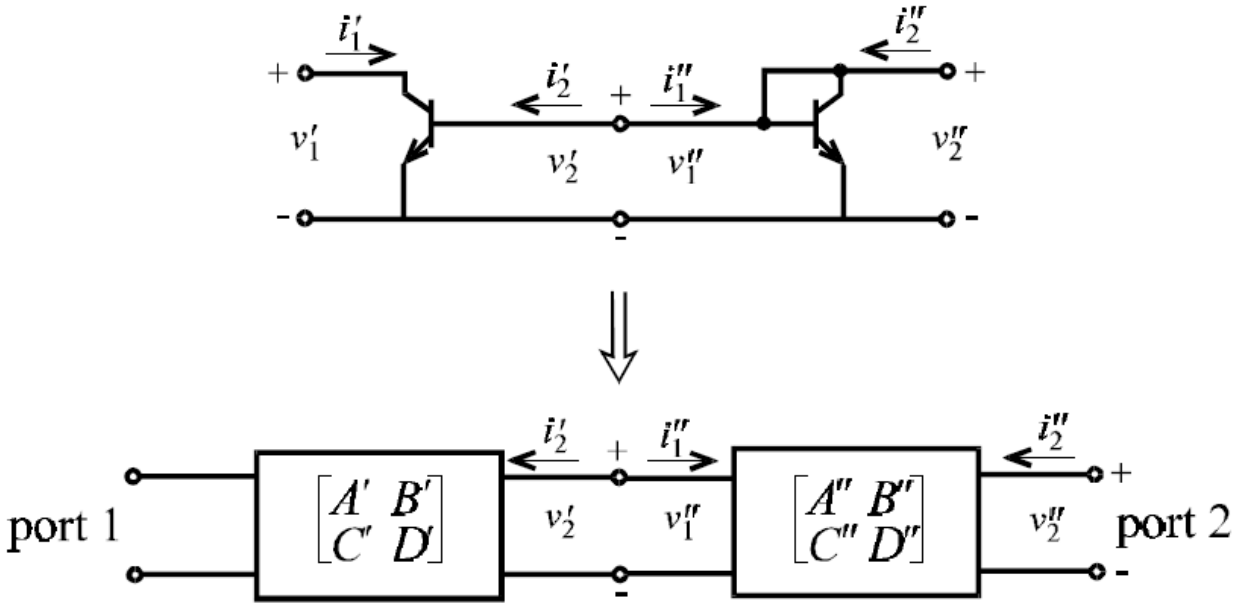
$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_3 & B_3 \\ C_3 & D_3 \end{bmatrix} \cdot \begin{bmatrix} V_3 \\ I_3 \end{bmatrix}$$




Çarpım sırası devre bağlantı sırasıyla aynı olmalı !!! [A].[B] ≠[B].[A]

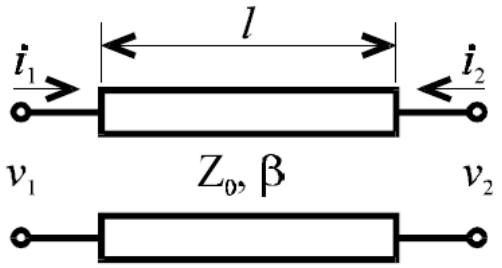
# ABCD Matrisi

Ardışıl bağlı devre analizinde çok kullanışlıdır

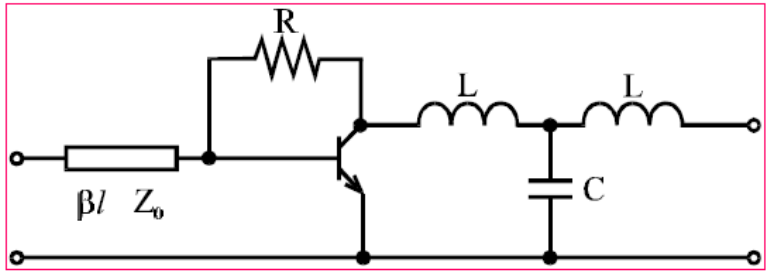


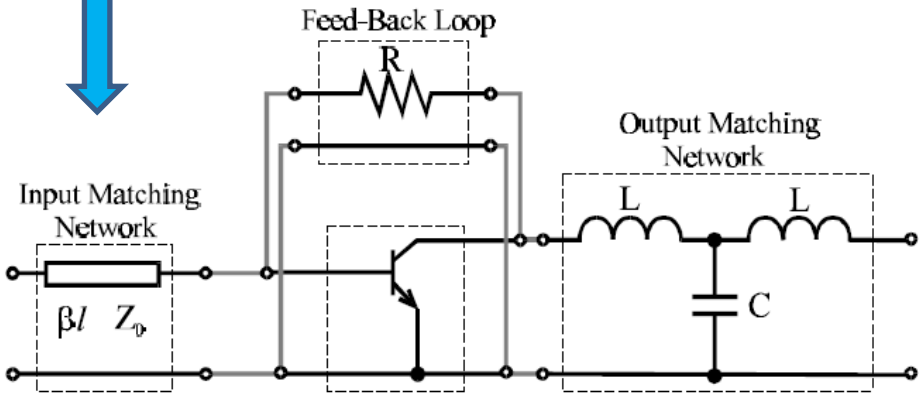

$$\begin{Bmatrix} v_1 \\ i_1 \end{Bmatrix} = \begin{bmatrix} A' & B' \\ C' & D' \end{bmatrix} \begin{bmatrix} A'' & B'' \\ C'' & D'' \end{bmatrix} \begin{Bmatrix} v''_2 \\ -i''_2 \end{Bmatrix}$$

# ABCD matrisi – İletim hattı

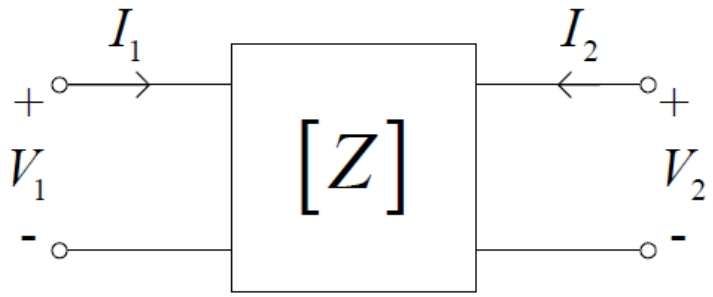



$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} \cos(\beta l) & jZ_0 \sin(\beta l) \\ j\dfrac{\sin(\beta l)}{Z_0} & \cos(\beta l) \end{bmatrix}$$



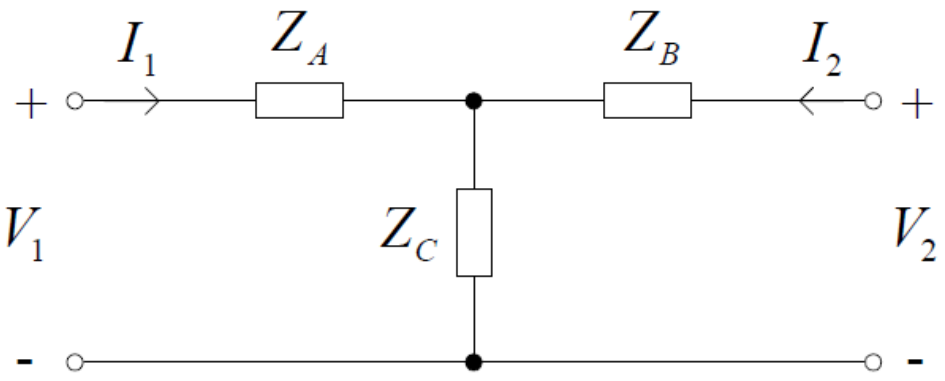
# Empedans (Z) Matrisi




$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \underbrace{\begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}}_{\equiv[Z]} \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$Z_{ij} = \left. \frac{V_i}{I_j} \right|_{I_k = 0, \forall k \neq j}$$

# Z Matrisi Örnek




$$Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0} = Z_A + Z_C$$

$$Z_{12} = \left.\frac{V_1}{I_2}\right|_{I_1=0} \Rightarrow V_1 = I_2 Z_C$$

$$Z_{21} = \left.\frac{V_2}{I_1}\right|_{I_2=0} \Rightarrow V_2 = I_1 Z_C$$

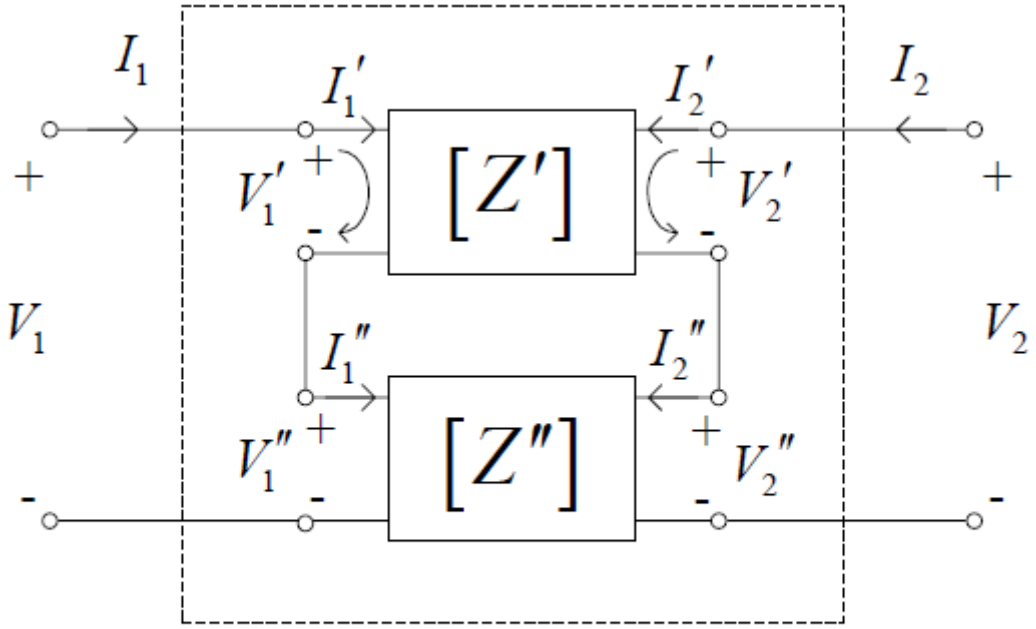
$$Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0} = Z_B + Z_C$$

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$[Z] = \begin{bmatrix} Z_A + Z_C & Z_C \\ Z_C & Z_B + Z_C \end{bmatrix}$$

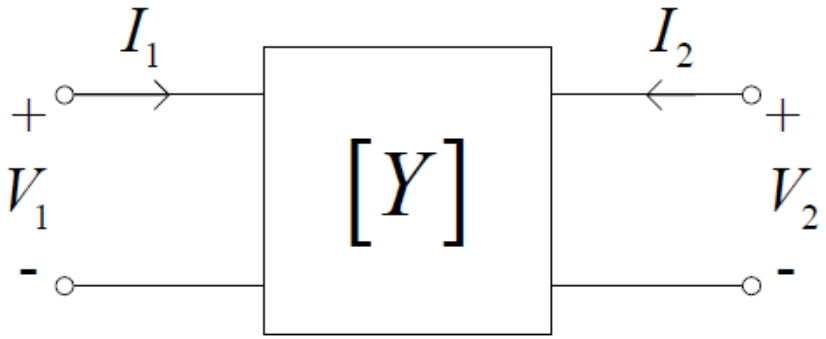
# Z Matrisi - Örnek

Seri bağlı devre analizinde kullanılır




$$[Z] = [Z'] + [Z'']$$

# Admitans (Y) Matrisi

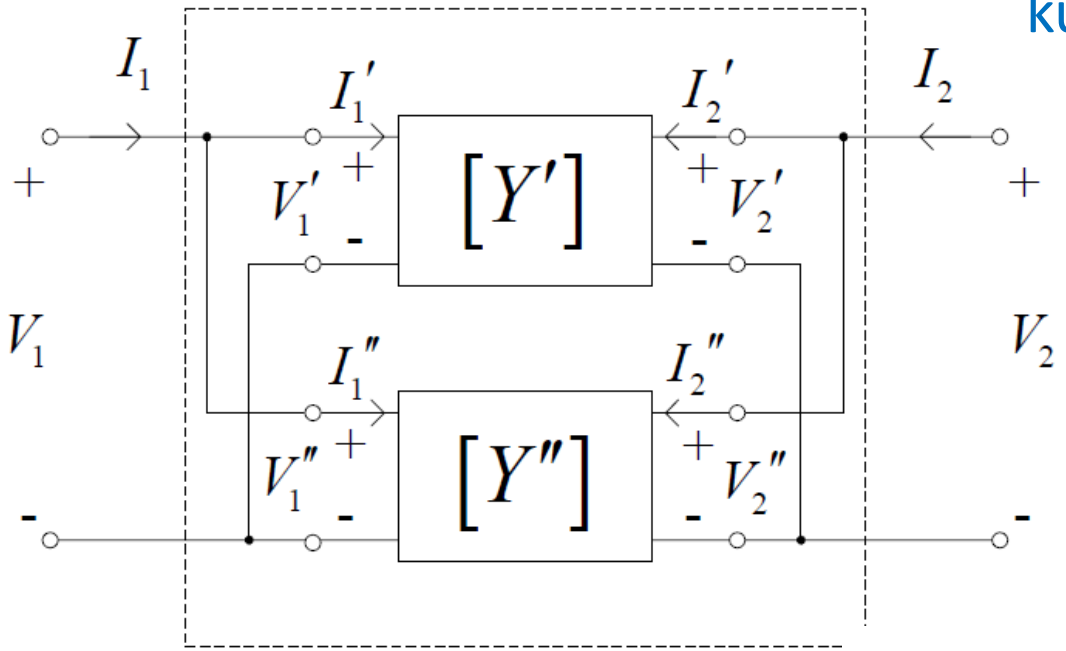



$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \underbrace{\begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix}}_{\equiv [Y]} \cdot \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$Y_{ij} = \left. \frac{I_i}{V_j} \right|_{V_k = 0, \forall k \neq j}$$

# Y Matrisi

Paralel bağlı devre analizinde kullanılır




$[Y]$

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} I_1' + I_1'' \\ I_2' + I_2'' \end{bmatrix} = [Y] \cdot \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$[Y] = [Y'] + [Y'']$$