

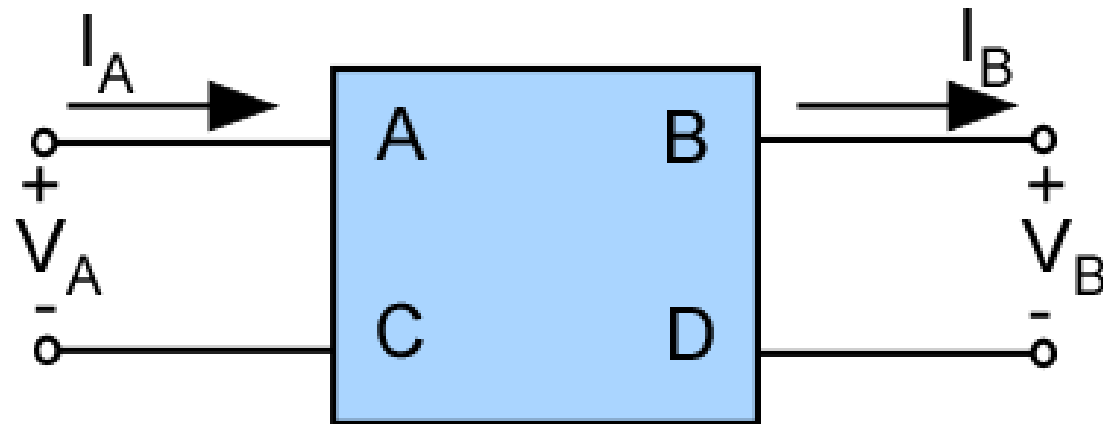
# ECE 453

# Wireless Communication Systems

## ABCD Parameters

Jose E. Schutt-Aine  
Electrical & Computer Engineering  
University of Illinois  
jesa@illinois.edu

# ABCD -Parameters



$$V_A = AV_B + BI_B$$

$$I_A = CV_B + DI_B$$

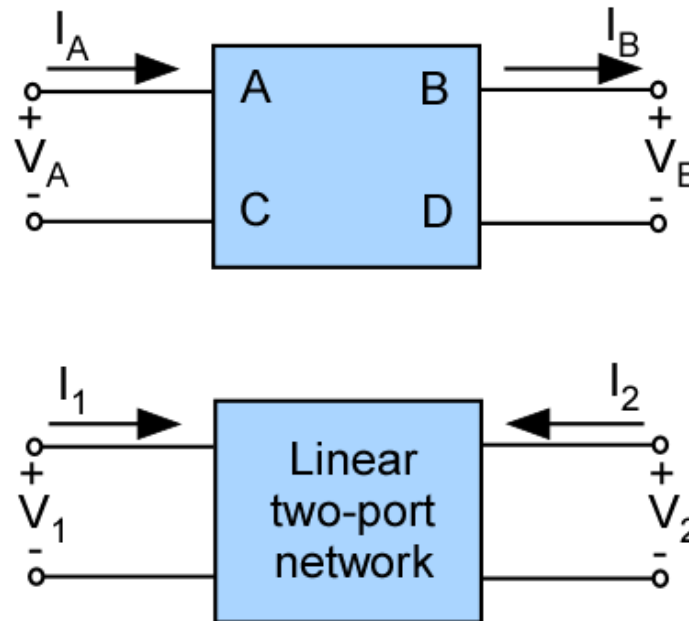
# ABCD -Parameters

$$V_A = V_1$$

$$V_B = V_2$$

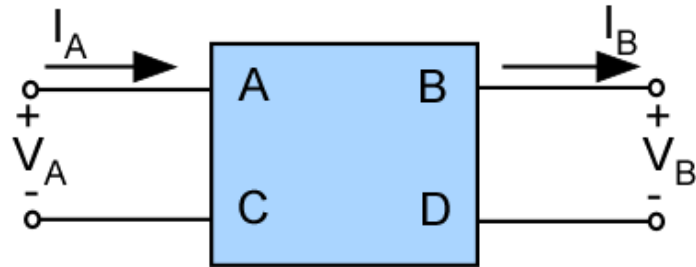
$$I_A = I_1$$

$$I_B = -I_2$$



Relationship with Z parameters is obtained by first expressing ABCD parameters in terms of Z parameters

# ABCD -Parameters



From

$$V_A = Z_{11}I_A - Z_{12}I_B$$

$$V_B = Z_{21}I_A - Z_{22}I_B$$

We get

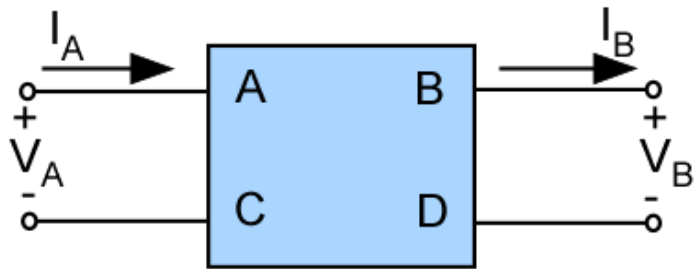


$$A = \frac{Z_{11}}{Z_{21}} \quad B = \frac{\Delta}{Z_{21}}$$

$$C = \frac{1}{Z_{21}} \quad D = \frac{Z_{22}}{Z_{21}}$$

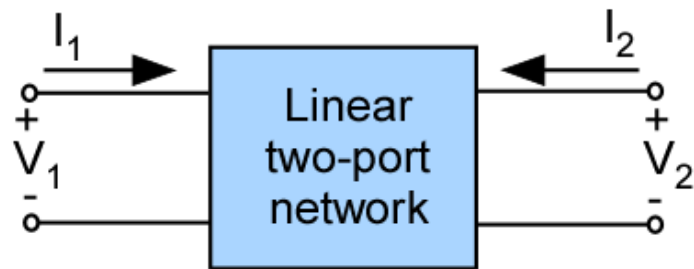
$$\Delta = Z_{11}Z_{22} - Z_{12}Z_{21}$$

# ABCD -Parameters



$$Z_{11} = \frac{A}{C}$$

$$Z_{11} = \frac{(AD - BC)}{C}$$



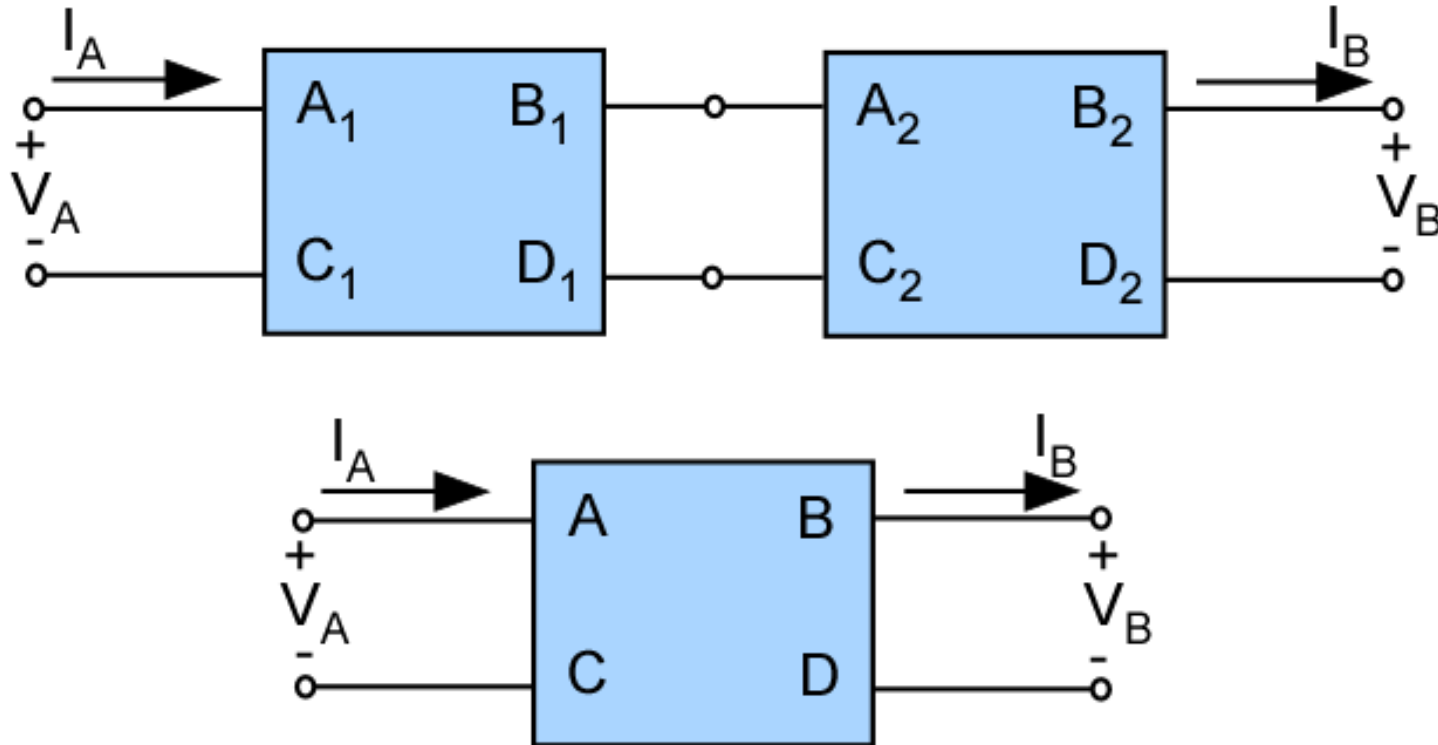
$$Z_{21} = \frac{1}{C}$$

$$Z_{22} = \frac{1}{C}$$

For a reciprocal network,  $Z_{21} = Z_{12}$ , therefore

$$AD - BC = 1 \quad \leftarrow \text{Reciprocity condition for ABCD parameters}$$

# ABCD -Parameters



When cascading two-ports, it is best to use ABCD parameters. Put voltage and currents in cascadable form with the input variables in terms of the output variables

$$ABCD = (ABCD)_1 \cdot (ABCD)_2$$