



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Computer aided power system analysis

Bus Admittance Matrix with mutual impedance (Contd.)

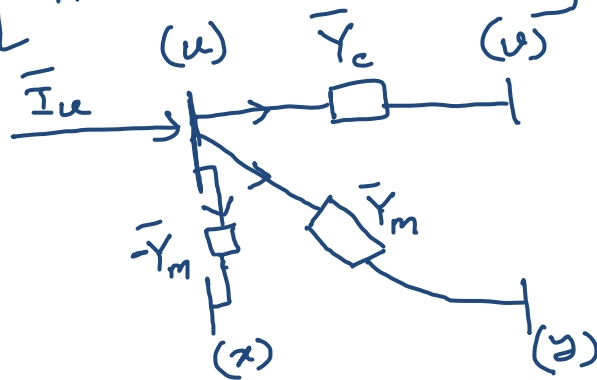
Prof. Biswarup Das

Department of Electrical Engineering



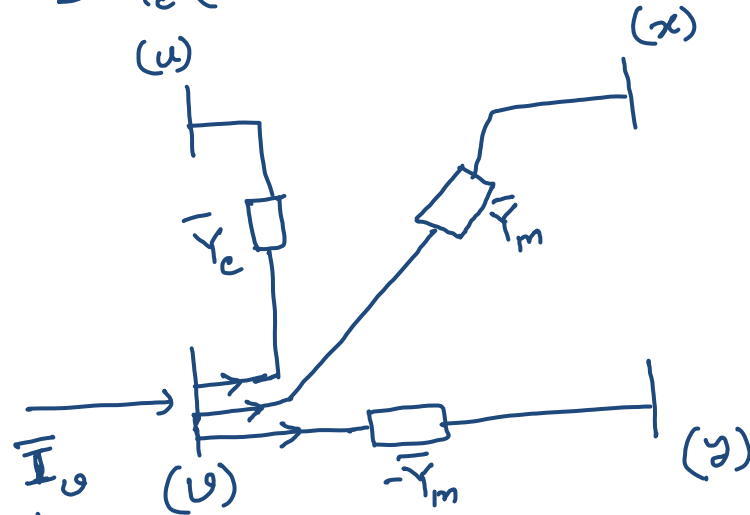
Therefore,

$$\begin{bmatrix} \bar{I}_u \\ \bar{I}_v \\ \bar{I}_x \\ \bar{I}_y \end{bmatrix} = \begin{bmatrix} \bar{Y}_c & -\bar{Y}_c & \bar{Y}_m & -\bar{Y}_m \\ -\bar{Y}_c & \bar{Y}_c & -\bar{Y}_m & \bar{Y}_m \\ \bar{Y}_m & -\bar{Y}_m & \bar{Y}_d & -\bar{Y}_d \\ -\bar{Y}_m & \bar{Y}_m & -\bar{Y}_d & \bar{Y}_d \end{bmatrix} \begin{bmatrix} \bar{V}_u \\ \bar{V}_v \\ \bar{V}_x \\ \bar{V}_y \end{bmatrix}$$

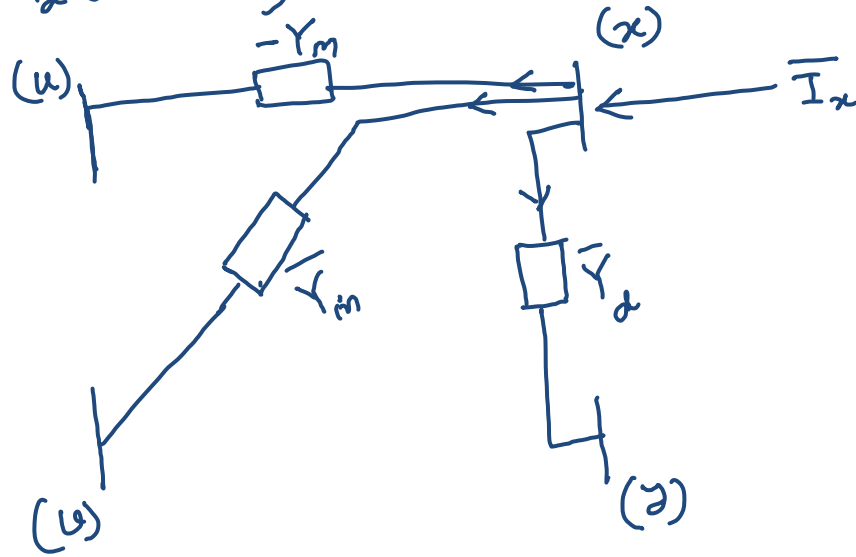


$$\begin{aligned} \Rightarrow \bar{I}_u &= \bar{Y}_c \bar{V}_u - \bar{Y}_c \bar{V}_v \\ &\quad + \bar{Y}_m \bar{V}_x - \bar{Y}_m \bar{V}_y \\ &= \bar{Y}_c \bar{V}_u - \bar{Y}_c \bar{V}_v + \bar{Y}_m \bar{V}_x \\ &\quad - \bar{Y}_m \bar{V}_y + \bar{Y}_m \bar{V}_u - \bar{Y}_m \bar{V}_u \\ &= \bar{Y}_c (\bar{V}_u - \bar{V}_v) + \bar{Y}_m (\bar{V}_u - \bar{V}_y) \\ &\quad - \bar{Y}_m (\bar{V}_u - \bar{V}_x) \end{aligned}$$

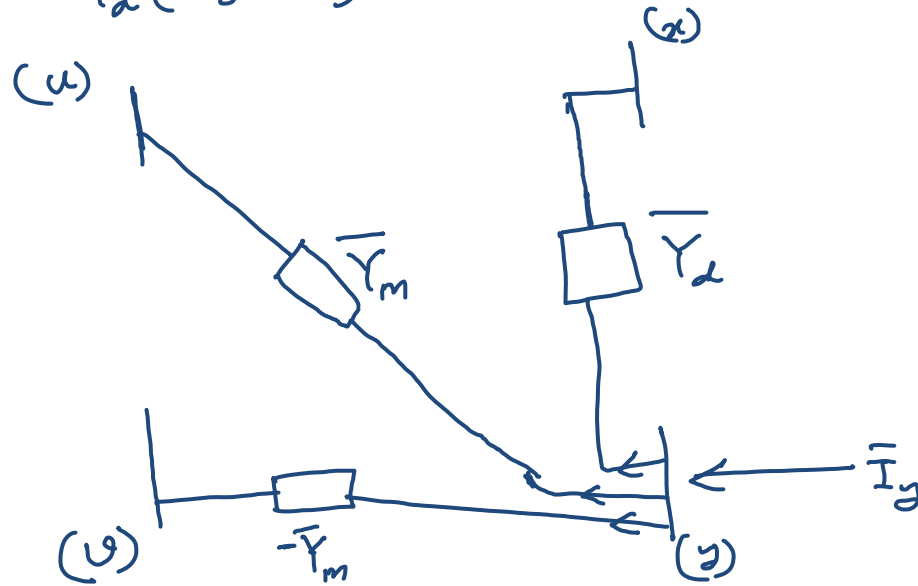
$$\begin{aligned}
 \bar{I}_o &= -\bar{Y}_c \bar{V}_u + \bar{Y}_c \bar{V}_o - \bar{Y}_m \bar{V}_x + \bar{Y}_m \bar{V}_y \\
 &= -\bar{Y}_c \bar{V}_u + \bar{Y}_c \bar{V}_o - \bar{Y}_m \bar{V}_x + \bar{Y}_m \bar{V}_y + \bar{Y}_m \bar{V}_o - \bar{Y}_m \bar{V}_o \\
 &= \bar{Y}_c (\bar{V}_o - \bar{V}_u) + \bar{Y}_m (\bar{V}_o - \bar{V}_x) - \bar{Y}_m (\bar{V}_o - \bar{V}_y)
 \end{aligned}$$

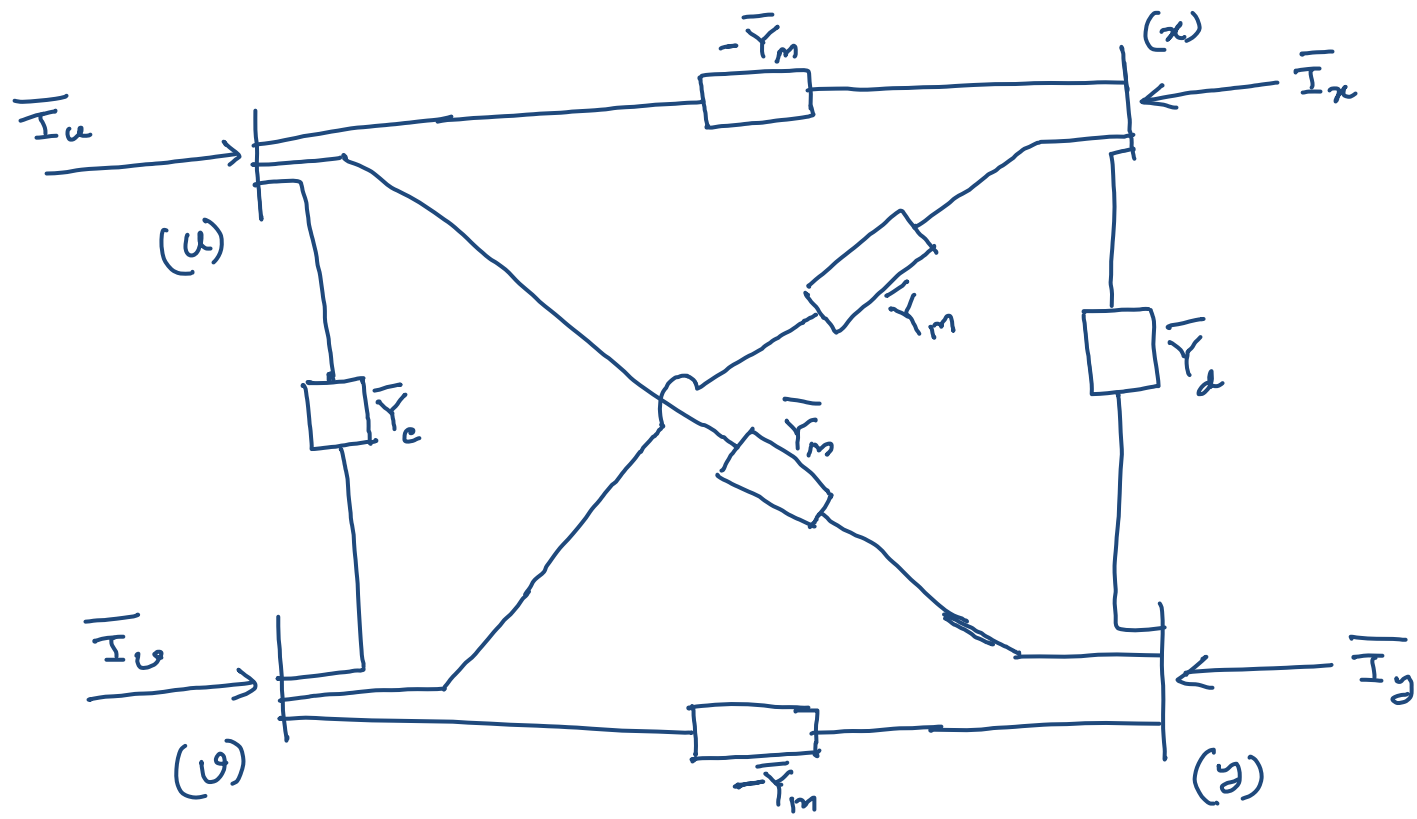


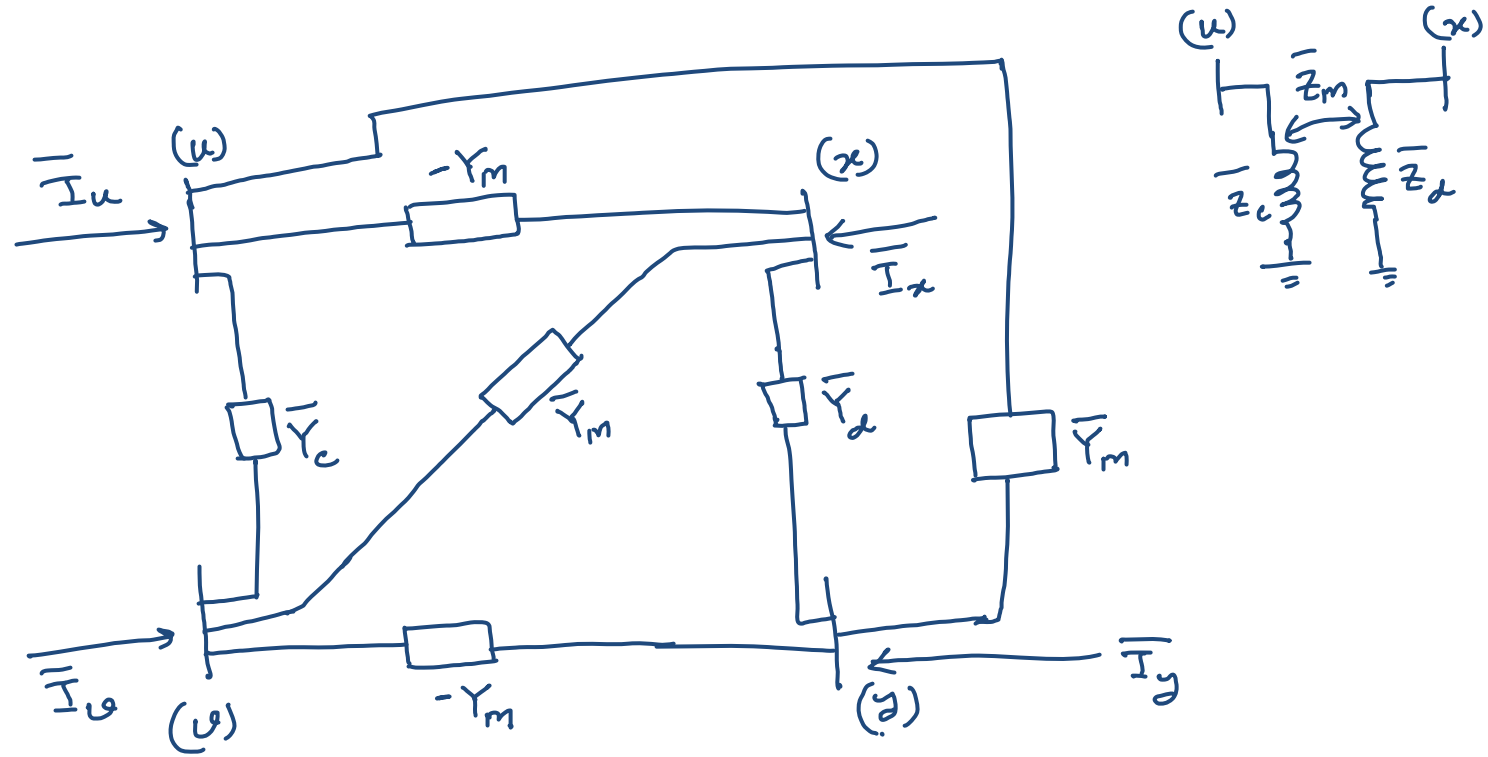
$$\begin{aligned}
 \bar{I}_x &= \bar{Y}_m \bar{V}_u - \bar{Y}_m \bar{V}_v + \bar{Y}_d \bar{V}_x - \bar{Y}_d \bar{V}_y \\
 &= \bar{Y}_m \bar{V}_u - \bar{Y}_m \bar{V}_v + \bar{Y}_d \bar{V}_x - \bar{Y}_d \bar{V}_y + \bar{Y}_m \bar{V}_x - \bar{Y}_m \bar{V}_x \\
 &= \bar{Y}_d (\bar{V}_x - \bar{V}_y) + \bar{Y}_m (\bar{V}_x - \bar{V}_v) - \bar{Y}_m (\bar{V}_x - \bar{V}_u)
 \end{aligned}$$

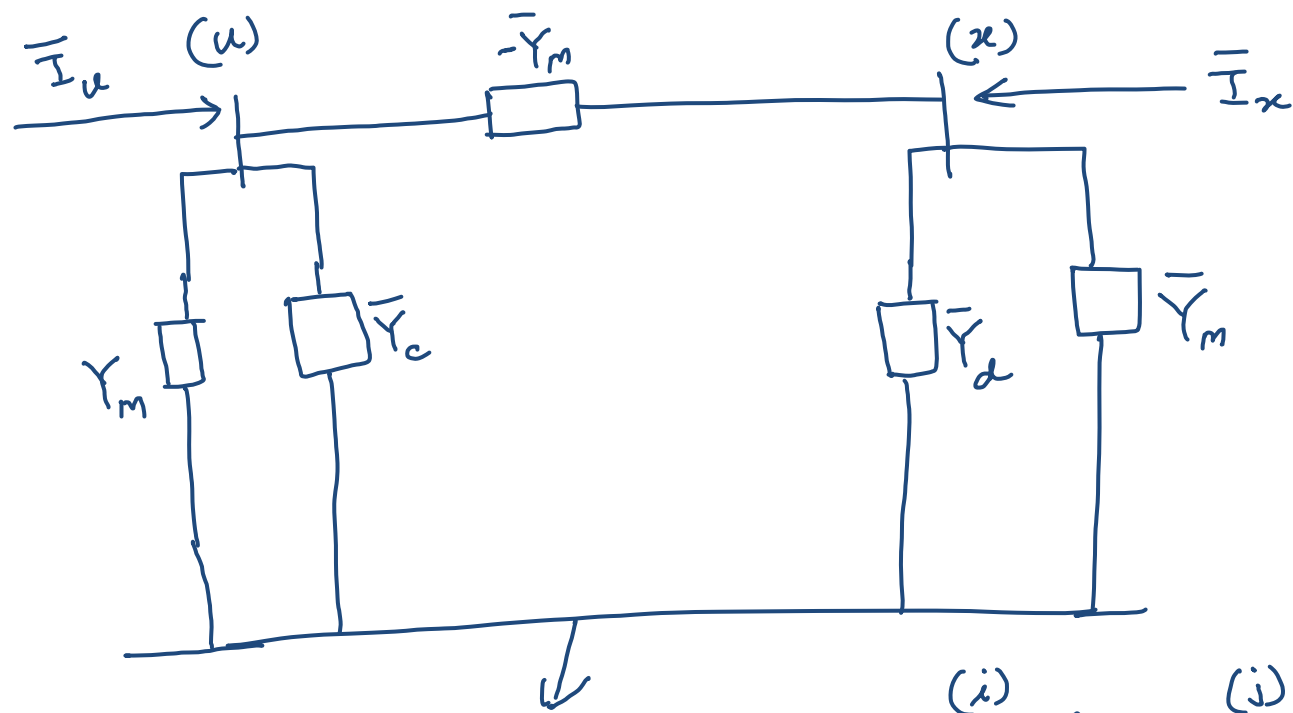


$$\begin{aligned}
 \bar{I}_y &= -\bar{Y}_m \bar{V}_u + \bar{Y}_m \bar{V}_v - \bar{Y}_d \bar{V}_x + \bar{Y}_d \bar{V}_y \\
 &= -\bar{Y}_m \bar{V}_u + \bar{Y}_m \bar{V}_v - \bar{Y}_d \bar{V}_x + \bar{Y}_d \bar{V}_y + \bar{Y}_m \bar{V}_y - \bar{Y}_m \bar{V}_y \\
 &= \bar{Y}_d (\bar{V}_y - \bar{V}_x) + \bar{Y}_m (\bar{V}_y - \bar{V}_u) - \bar{Y}_m (\bar{V}_y - \bar{V}_v)
 \end{aligned}$$









Common point

