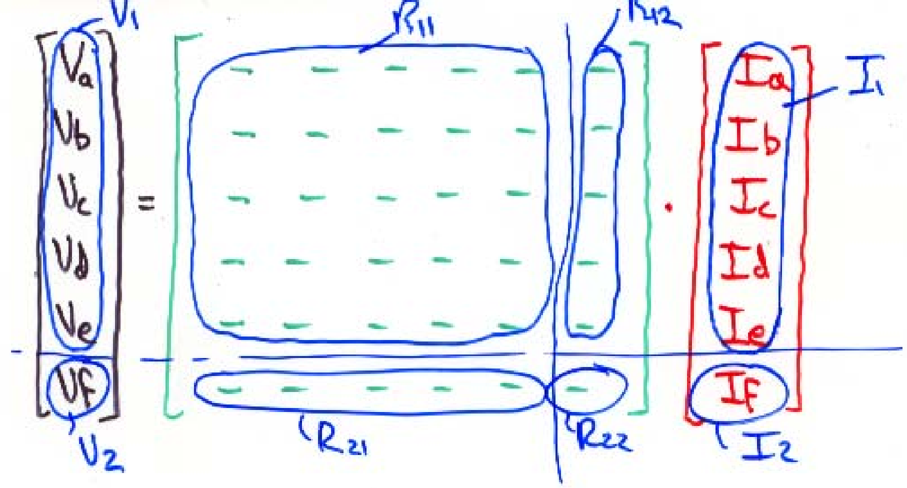
The following shows a compound matrix, and how this form of matrix can be used to eliminate variables from a network whilst maintaining their influence on other parameters......

* DO NOT COPY THIS *

Compound Matrices....



- knowledge of i's flowing in ALL windings not necessary.
  ↳ but can't neglect their influence on other windings.

- $$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} \Rightarrow \begin{aligned} V_1 &= R_{11} I_1 + R_{12} I_2 \quad -① \\ V_2 &= R_{21} I_1 + R_{22} I_2 \quad -② \end{aligned}$$

- To eliminate I_f .... (now called I_2)....

  $\times$ ② by R_{22}^{-1} $\Rightarrow R_{22}^{-1} V_2 = R_{22}^{-1} R_{21} I_1 + R_{22}^{-1} R_{22} I_2$

  $$R_{22}^{-1} V_2 = R_{22}^{-1} R_{21} I_1 + I_2$$

  $$\Rightarrow I_2 = R_{22}^{-1} V_2 - R_{22}^{-1} R_{21} I_1 \quad -③$$

- Sub. ③ into ① $\Rightarrow V_1 = R_{11} I_1 + R_{12} (R_{22}^{-1} V_2 - R_{22}^{-1} R_{21} I_1)$

  $$= R_{11} I_1 + R_{12} R_{22}^{-1} V_2 - R_{12} R_{22}^{-1} R_{21} I_1$$

  $$\Rightarrow \underbrace{V_1 - R_{12} R_{22}^{-1} V_2}_{V'} = \underbrace{I_1}_{= I_1} \underbrace{(R_{11} - R_{12} R_{22}^{-1} R_{21})}_{R'}$$