

ELEMENT	SYMBOL	MATRIX	EQUATIONS
CURRENT SOURCE		$\begin{bmatrix} I_j \\ -J \end{bmatrix}$ SOURCE VECTOR	$I_j = J$ $I_j' = -J$
VOLTAGE SOURCE		$\begin{bmatrix} V_j & V_j' & I \\ 1 & -1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$ SOURCE VECTOR $\begin{bmatrix} E \\ -E \end{bmatrix}$	$V_j - V_j' = E$ $I_j = I$ $I_j' = -I$
OPEN CIRCUIT		—	$V = V_j - V_j'$
SHORT CIRCUIT		$\begin{bmatrix} V_j & V_j' & I \\ 1 & -1 & -1 \end{bmatrix}$	$V_j - V_j' = 0$ $I_j = I$ $I_j' = -I$
ADMITTANCE		$\begin{bmatrix} V_j & V_j' \\ y & -y \end{bmatrix}$	$I_j = y(V_j - V_j')$ $I_j' = -y(V_j - V_j')$
IMPEDANCE		$\begin{bmatrix} V_j & V_j' & I \\ 1 & -1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$	$V_j - V_j' - zI = 0$ $I_j = -I_j' = I$
NULLATOR		$\begin{bmatrix} V_j & V_j' \\ 1 & -1 \end{bmatrix}$	$V_j - V_j' = 0$ $I_j = I_j' = 0$
NORATOR		$\begin{bmatrix} I_j & I_j' \\ 1 & -1 \end{bmatrix}$	$V, I \text{ ARE ARBITRARY}$
VCT		$\begin{bmatrix} V_j & V_j' \\ g & -g \end{bmatrix}$	$I_j = 0$ $I_j' = 0$ $I_k = g(V_j - V_j')$ $I_k' = -g(V_j - V_j')$

Fig. 4.4.1. Ideal elements in the modified nodal formulation without graphs.

ELEMENT	SYMBOL	MATRIX	EQUATIONS
VVT		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I \\ 1 & -1 & -\mu & \mu & -1 \\ 1 & -1 & \mu & -\mu & 1 \end{bmatrix}$	$-\mu V_j + \mu V_j' + V_k$ $-V_k' = 0$ $I_k = I$ $I_k' = -I$
CCT		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I \\ 1 & -1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 & a \end{bmatrix}$	$V_j - V_j' = 0$ $I_j = -I_j' = I$ $I_k = -I_k' = aI$
CVT		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I \\ 1 & -1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 & -r \end{bmatrix}$	$V_j - V_j' = 0$ $V_k - V_k' - rI_1 = 0$ $I_j = -I_j' = I_1$ $I_k = -I_k' = I_2$
OPERATIONAL AMPLIFIER		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I \\ 1 & -1 & 1 & -1 & -1 \end{bmatrix}$	$V_j - V_j' = 0$ $I_k = -I_k' = I$
CONVERTOR		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I \\ 1 & -1 & -K_1 & K_2 & 1 \\ 1 & -1 & K_1 & -K_2 & -1 \end{bmatrix}$	$V_j - V_j' - K_1 V_k + K_2 V_k' = 0$ $I_j = -I_j' = I$ $I_k = -I_k' = -K_2 I$ FOR IDEAL TRANSFORMER $K_1 = K_2 = n$
TRANSFORMER		$\begin{bmatrix} V_j & V_j' & V_k & V_k' & I_1 & I_2 \\ 1 & -1 & -1 & 1 & -1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 \\ 1 & -1 & -sL_1 & sM & -sM & -sL_2 \\ 1 & -1 & sM & -sL_2 & sL_1 & -sM \end{bmatrix}$	$V_j - V_j' - sL_1 I_1 - sM I_2 = 0$ $V_k - V_k' - sM I_1 - sL_2 I_2 = 0$ $I_j = -I_j' = I_1$ $I_k = -I_k' = I_2$

Fig. 4.4.1. (Continued)