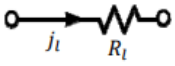
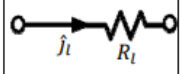
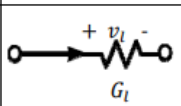
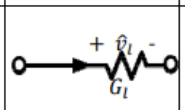
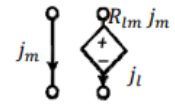
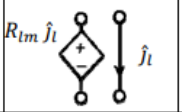
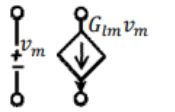
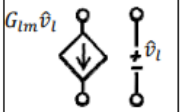
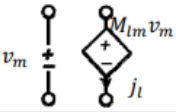
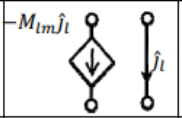
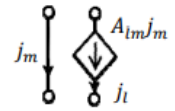
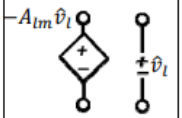
SENSITIVITY CALCULATION

The Table below show the branch-by-branch construction of N'. After N' is obtained, any element variation can be represented as an added source. A change ΔR of a resistor R as a voltage source j.ΔR; a change ΔG_{lm} in a transconductor G_{lm} as a current source $\Delta G_{lm}\, v_m$, etc. Then inter-reciprocity can be used to give the sensitivity. Use the Table below for the calculation.

Element in N			Element in $\hat{N}$			Sensitivity
Element Type	Branch Relation	Symbol	Element Type	Branch Relation	Symbol	$S_p \triangleq \frac{\partial v_o}{\partial p}$ or $\frac{\partial j_o}{\partial p}$
R_l	$v_l = R_l\, j_l$		R_l	$\hat{v}_l = R_l\, \hat{j}_l$		$S_{R_l} = -\hat{j}_l j_l$ $S_{R_l} = \frac{\partial v_o}{\partial R_l}$
G_l	$j_l = G_l\, v_l$		G_l	$\hat{j}_l = G_l\, \hat{v}_l$		$S_{G_l} = \hat{v}_l v_l$
$CCVS$	$v_m = 0$ $v_l = R_{lm}\, j_m$		$CCVS$	$\hat{v}_m = R_{lm}\, \hat{j}_l$ $\hat{v}_l = 0$		$S_{R_{lm}} = -\hat{j}_l j_m$
$VCCS$	$j_m = 0$ $j_l = G_{lm}\, v_m$		$VCCS$	$\hat{j}_m = G_{lm}\, \hat{v}_l$ $\hat{j}_l = 0$		$S_{G_{lm}} = \hat{v}_l v_m$
$VCVS$	$j_m = 0$ $v_l = M_{lm}\, v_m$		$CCCS$	$\hat{j}_m = -M_{lm}\, \hat{j}_l$ $\hat{v}_l = 0$		$S_{M_{lm}} = -\hat{j}_l v_m$
$CCCS$	$v_m = 0$ $j_l = A_{lm} j_m$		$VCVS$	$\hat{v}_m = -A_{lm}\, \hat{v}_l$ $\hat{j}_l = 0$		$S_{A_{lm}} = \hat{v}_l j_m$

Excitations of $\hat{N}$: 1A for $\partial v_0 / \partial x$, Δv_0