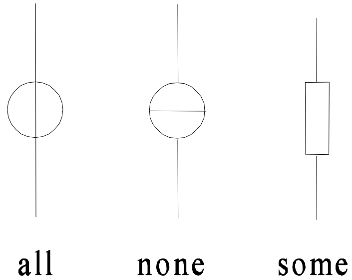
3. Solution of a resistive network

Tree:
A **tree** is a set of network branches including all nodes without forming a loop.
(A **cotree** is the complementary set to a tree which does not form a cutset.)

Choose a **tree**, which contains
- **all** voltage sources,
- **no** current source,
- **some** resistors.



If possible choose resistors such that
- **all** tree resistors are **current controlled**, v=r(i), while
- **all cotree** resistors are **voltage controlled**, i=g(v).

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Every cotree branch closes a **loop**.
This leads to the set of b-n+1 linearly independent loop equations.

$(\mathbf{v}_{co}, \mathbf{v}_{is}) = L_{loop}(\mathbf{v}_{tr}, \mathbf{e}_{tr}(t))$ ($\mathbf{e}_{tr}(t)$ – voltage sources of the tree)

Every tree branch forms a **cut**set.
This leads to the set of n-1 linearly independent cutset equations.

$(\mathbf{i}_{tr}, \mathbf{i}_{vs}) = L_{cut}(\mathbf{i}_{co}, \mathbf{e}_{co}(t))$ ($\mathbf{e}_{co}(t)$ – current sources of the cotree)

Now the resistor equations, $i=g(v)$ or $v=r(i)$, lead to a **reduced equation system**:
NR instead of 2b variables, namely $\mathbf{v}_{tr}$ (voltages of the tree resistors) and $\mathbf{i}_{co}$ (currents of the cotree resistors).

If the tree (cotree) resistors are current (voltage) controlled → explicit form:

$\mathbf{i}_{co} = g(\mathbf{v}_{co}) = g(\mathbf{v}_{tr}, \mathbf{e}_{tr}(t))$
$\mathbf{v}_{tr} = r(\mathbf{i}_{tr}) = r(\mathbf{i}_{co}, \mathbf{e}_{co}(t))$