

Nodal Analysis

Electrical Engineering

The node-voltage method, from choosing a datum to checking the power balance.

Unknowns are node voltages; equations come from KCL.

1 Pick the reference node

Choose the node with the most branches, call it 0 V, label the rest V_1, V_2 .

2 Write KCL at each node

Sum the currents leaving through every branch as $(v_{\text{node}} - v_{\text{other}})/R$.

3 Deal with voltage sources

A source between two nodes becomes a supernode; add its defining equation.

4 Solve the system

$n - 1$ unknowns need $n - 1$ independent equations. Matrix or substitution.

5 Back-substitute and check

Branch currents follow from node voltages; power in must equal power out.

Nodal analysis scales with node count, mesh analysis with mesh count. Count both before you commit to either.