First Netlist Example

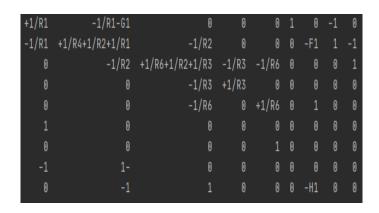```
V1 1 0 40
R6 3 5 4
R4 2 0 10
R2 3 2 9
R3 4 3 8
R1 2 1 2
I1 0 4 1
G1 0 1 2 0 2
F1 0 2 V2 3
H1 3 2 V2 2
E1 2 1 2 0 2
V2 5 0 0
```
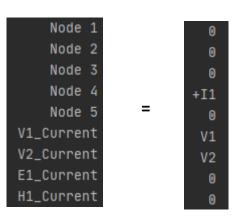
## Spice Results

```
[--- Operating Point ---

V(1):   40   voltage
V(3):   -80   voltage
V(5):   0   voltage
V(2):   -40   voltage
V(4):   -72   voltage
I(F1):   -60   device_current
I(H1):   25.4444   device_current
I(I1):   1   device_current
I(R1):   -40   device_current
I(R3):   1   device_current
I(R2):   -4.44444   device_current
I(R4):   -4   device_current
I(R6):   -20   device_current
I(G1):   -80   device_current
I(E1):   5   device_current
I(V2):   -20   device_current
I(V1):   -115   device_current
```
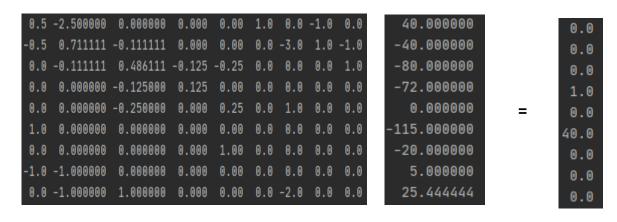
A.X = Z

## Symbolic Solution

```
+1/R1      -1/R1-G1            0        0      0  1   0 -1  0           Node 1                0
-1/R1   +1/R4+1/R2+1/R1      -1/R2      0      0  0  -F1  1 -1          Node 2                0
  0        -1/R2    +1/R6+1/R2+1/R3  -1/R3  -1/R6  0   0  0  1          Node 3                0
  0          0            -1/R3    +1/R3     0  0   0  0  0             Node 4              +I1
  0          0            -1/R6      0    +1/R6  0   1  0  0    =       Node 5       =        0
  1          0              0        0      0  0   0  0  0           V1_Current             V1
  0          0              0        0      1  0   0  0  0           V2_Current             V2
 -1         1-              0        0      0  0   0  0  0           E1_Current              0
  0         -1              1        0      0  0  -H1  0  0          H1_Current              0
```

Numerical Solution

```
0.5 -2.500000  0.000000  0.000  0.00  1.0  0.0 -1.0  0.0      40.000000              0.0
-0.5  0.711111 -0.111111  0.000  0.00  0.0 -3.0  1.0 -1.0     -40.000000             0.0
0.0 -0.111111  0.486111 -0.125 -0.25  0.0  0.0  0.0  1.0      -80.000000             0.0
0.0  0.000000 -0.125000  0.125  0.00  0.0  0.0  0.0  0.0      -72.000000             1.0
0.0  0.000000 -0.250000  0.000  0.25  0.0  1.0  0.0  0.0       0.000000   =          0.0
1.0  0.000000  0.000000  0.000  0.00  0.0  0.0  0.0  0.0     -115.000000            40.0
0.0  0.000000  0.000000  0.000  1.00  0.0  0.0  0.0  0.0      -20.000000             0.0
-1.0 -1.000000  0.000000  0.000  0.00  0.0  0.0  0.0  0.0      5.000000              0.0
0.0 -1.000000  1.000000  0.000  0.00  0.0 -2.0  0.0  0.0      25.444444             0.0
```

Second Netlist Example

```
Vbatt 1 0 40
R6 3 0 4
R4 2 0 10
R2 3 2 9
R3 4 3 8
R1 2 1 2
Isrc 0 4 1
```

Spice Results

```
⌈          --- Operating Point ---

V(1):          40              voltage
V(3):          12              voltage
V(2):          30              voltage
V(4):          20              voltage
I(Isrc):        1              device_current
I(R1):         -5              device_current
I(R3):          1              device_current
I(R2):         -2              device_current
I(R4):          3              device_current
I(R6):          3              device_current
I(Vbatt):      -5              device_current
```
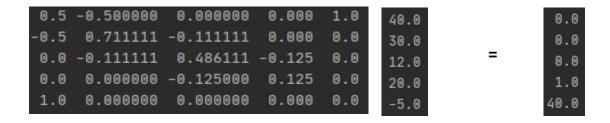
A.X = Z

Symbolic Solution

```
+1/R1          -1/R1                    0       0   1            Node 1                  0
-1/R1   +1/R4+1/R2+1/R1          -1/R2    0   0            Node 2                  0
   0            -1/R2  +1/R6+1/R2+1/R3  -1/R3  0            Node 3          =       0
   0               0            -1/R3   +1/R3  0            Node 4                +Isrc
   1               0                    0       0   0      Vbatt_Current            Vbatt
```

Numerical Solution

```
0.5  -0.500000   0.000000   0.000   1.0       40.0              0.0
-0.5   0.711111  -0.111111   0.000   0.0       30.0              0.0
0.0  -0.111111   0.486111  -0.125   0.0       12.0     =        0.0
0.0   0.000000  -0.125000   0.125   0.0       20.0              1.0
1.0   0.000000   0.000000   0.000   0.0       -5.0             40.0
```

Both Spice and the implemented simulator give same result as they built based on MNA Algorithm.