MATLAB

Suppose you have a set of nodal equations, such as Practice Problem 4.1 on page 83 of the text:

$$\begin{aligned} 4v_1 - \quad v_2 &= -75 \\ -4v_1 + 19v_2 &= 120 \end{aligned}$$

You can use Cramer's rule and solve 2x2 determinants to find $v_1 = -18.125$ V and $v_2 = 2.5000$ V.

You can also solve this with MATLAB. We have $A*V = C$, where

$$A = \begin{matrix} 4 & -1 \\ -4 & 19 \end{matrix} \qquad V = \begin{matrix} v_1 \\ v_2 \end{matrix} \qquad C = \begin{matrix} -75 \\ 120 \end{matrix}$$

Solving the system simultaneously simply means finding $V = A^{-1} * C$, where A^{-1} is the inverse of A, i.e., $A^{-1} * A = 1$.

Open MATLAB and you will see something like the following:

<M A T L A B>

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To get started, select MATLAB Help or Demos from the Help menu.

>>

row 1 row 2

Type in the coefficients, **A=[4 -1;-4 19]**, and hit "return"(be sure to put a space after 4 and -4); MATLAB will print the following:

A =

4 -1 ← row-1

-4 19 ← row-2

Now type in the right-hand side, **C=[-75;120]**, and hit "return"; MATLAB will print the following:

C =

-75

120

Now type in **V=A^-1*C** and hit "return"; MATLAB will print the following:

V =

-18.1250

2.5000

Compare with Practice Problem 4.1 in the text.

MATLAB can save a lot of labor with large determinants, that is, more nodes.

Consider Example 4.2 on pages 83-84; the three nodal equations are:

$$0.5833\ v_1 - 0.3333\ v_2 - 0.2500\ v_3 = -11$$

$$-0.3333\ v_1 + 1.4762\ v_2 - 0.1429\ v_3 = 3$$

$$-0.2500\ v_1 - 0.1429\ v_2 + 0.5929\ v_3 = 25$$

The text example uses Cramer's rule, which requires you to solve 3x3 determinants. The MATLAB solution is:

```
>> A=[0.5833 -0.3333 -0.2500;-0.3333 1.4762 -0.1429;-0.2500 -0.1429 0.5929]

A =

    0.5833   -0.3333   -0.2500
   -0.3333    1.4762   -0.1429
   -0.2500   -0.1429    0.5929

>> C=[-11;3;25]

C =

   -11
     3
    25

>> V=A^-1*C

V =

    5.4124
    7.7375
   46.3127

>>
```

Compare with the values on page 84 of the text found using Cramer's rule.

Using MATLAB (see appendix 2)

$$\underbrace{\begin{bmatrix} 0.5833 & -0.3333 & -0.25 \\ -0.3333 & 1.4762 & -0.1429 \\ -0.25 & -0.1429 & 0.5929 \end{bmatrix}}_{3\times 3 \text{ matrix } a} \underbrace{\begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}}_{\text{column vector } b} = \underbrace{\begin{bmatrix} -11 \\ 3 \\ 25 \end{bmatrix}}_{\text{column vector } c}$$

$$ab = c$$

Solution $b = a^{-1}c$

In MATLAB, we write

```
>> a = [0.5833 -0.3333 -0.25; row 2 ; row 3];
>> c = [-11; 3; 25];
>> b = a^-1*c
b =
    5.4124
    7.7375
   46.3127
>>
```

← solution returned by MATLAB

(row 1 ~~column 1~~, row 2 ~~column 2~~, row 3 ~~column 3~~)

Solving KCL using the symbolic processor
on MATLAB.

```
>> eqn1 = '-8-3 = (v1-v2)/3 + (v1-v3)/4';
>> eqn2 = '-(-3) = (v2-v1)/3 + v2/1 + (v2-v3)/7';
>> eqn3 = '-(-25) = v3/5 + (v3-v2)/7 + (v3-v1)/4';
>> answer = solve(eqn1, eqn2, eqn3, 'v1', 'v2', 'v3');
>> answer.v1
ans =
   720/133
```

solution is returned as a 'structure'

```
>> answer.v2
ans =
   147/19
>> answer.v3
ans =
  880/19
>>
```