Solving Linear Equations in Matlab

A Supplemental Note to Lecture #3

Consider the example of the node voltage method that we did in lecture, where we ended up with the matrix equation:

$$\begin{bmatrix} -4/3 & 1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} -4 \\ 0 \end{bmatrix}$$

We can solve this matrix equation $Ax=y$ for the column vector $x=(v_1, v_2)$ by left-multiplying both sides of this equation by the inverse of the 2x2 matrix $A = \begin{bmatrix} -4/3 & 1 \\ 1 & -2 \end{bmatrix}$ to get the equation $x = A^{-1}y$:

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} -4/3 & 1 \\ 1 & -2 \end{bmatrix}^{-1} \begin{bmatrix} -4 \\ 0 \end{bmatrix}.$$

To enter the matrix A into Matlab (or Scilab), type:

```
-->A=[-4/3, 1; 1, -2]
 A  =

  - 1.3333333    1.
    1.         - 2.
```

To compute its inverse $B=A^{-1}$, type:

```
-->B=inv(A)
 B  =

  - 1.2  - 0.6
  - 0.6  - 0.8
```

Or in other words, $B = A^{-1} = \begin{bmatrix} -6/5 & -3/5 \\ -3/5 & -4/5 \end{bmatrix} = -\begin{bmatrix} 6 & 3 \\ 3 & 4 \end{bmatrix}/5.$

And then to multiply this matrix inverse by the column vector y = (-4, 0) of constants, just do:

```
-->B*[-4; 0]
 ans  =

    4.8
    2.4
```

So in other words, we have that v_1 = 4.8V, and v_2 = 2.4V, which is the same answer that we derived in class using Cramer's rule.

Of course, you can also get the answer all on one line (without explicitly naming *A* or *B*) by just typing:

```
-->inv([-4/3, 1; 1, -2])*[-4; 0]
 ans  =

    4.8
    2.4
```

So that's easy to do.

The same method will work for any matrix rank (number of rows/columns), which for large matrices is of course much easier than doing the calculations by hand.