Kirchhoff’s Rules – Matrix Solution using a TI-83 Calculator

For those of you with a Texas Instruments graphing calculator, there is a convenient way of solving the system of equations. Refer to the corresponding PHYS 203 Web page and the Excel spreadsheet to see how the matrices are set up.

After you establish what the three equations are and have them properly arranged, turn on the calculator and hit the “Matrix” button. Then go to the “Edit” button, and hit “Enter” when the cursor is on “A”. Make the matrix a 3 x 3, as there are three equations and three unknowns. Keeping the order of the unknowns consistent, type in the coefficient, and place a zero in the space if there isn’t a variable for that equation. For example, the equation

\[ i_1 + i_2 - i_3 = 0 \]

would read, in the first line of the matrix \([1 \ 1 \ -1]\). After entering the 9 values into this matrix corresponding to the coefficients in the three equations, hit “2nd” and then “Mode”, which really uses the “Quit” function. To set up the V vector, go back to the “Matrix” mode and set up a 3 x 1 matrix for “B”. Put in the answers to the respective equations, making sure to keep the order consistent. For example, the equation \( i_1 + i_2 - i_3 = 0 \) would have a V vector value of \([0]\), as the value on the right hand side of the equal sign. After these values have been put in the calculator, hit “2nd” “Mode” to quit again, and at the calculator prompt, type the following: \([A]^{-1}[B]\) for your answer. This does exactly the same thing Excel does, but allows you to do it with your calculator.

**Summary**

Step 1. Turn on the calculator
Step 2. Go to the Matrix menu
Step 3. Set up a 3 x 3 matrix and enter the values
Step 4. Close the program by hitting “2nd” and then “Mode”
Step 5. Set up a 3 x 1 matrix and enter the values
Step 6. Close the program by hitting “2nd” and then “Mode”
Step 7. At the prompt, multiply the inverse \((-1)\) of the 3 x 3 matrix times the 3 x 1 matrix. Specifically, type: \([A]^{-1}[B]\)