Solving Simultaneous Equations in Excel
GE 2130 – Engineering Mechanics - Statics

The solution of simultaneous linear equations in Microsoft Excel is easily done using matrices.

**MATRIX MULTIPLICATION**

\[
[B] = \begin{bmatrix}
5 & 2 & 1 \\
4 & 7 & 9 \\
-3 & 4 & 2
\end{bmatrix}
\]

\[
[C] = \begin{bmatrix}
1 & 2 \\
3 & 4 \\
2 & 1
\end{bmatrix}
\]

Calculate \([B] \times [C]\) and \([C] \times [B]\).

In order to multiply matrices in Excel, use the following steps:

1. Enter the matrices to be multiplied, one number per cell.
2. Select the cell range for the answer.
3. Use the `mmult` command.
4. **Press Ctrl+Shift+Enter.**

**THE IDENTITY MATRIX**

The identity matrix, \([I]\), is always square \((m \times m)\) and has the following form:

\[
[I]_{m \times m} = \begin{bmatrix}
1 & 0 & 0 & \cdots & 0 \\
0 & 1 & 0 & \cdots & 0 \\
0 & 0 & 1 & \cdots & 0 \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
0 & 0 & 0 & \cdots & 1
\end{bmatrix}
\]

The identity matrix acts like the scalar "1" for matrix multiplication in that

\[
[I]_{m \times m} \times [A]_{m \times n} = [A]_{m \times n}
\]

Verify that \([I] \times [C] = [C]\) for the matrix \([C]\) above.
**MATRIX INVERSE**

The inverse of a matrix $[A]$ is given by $[A]^{-1}$ and has the property that:

$$[A]^{-1} \times [A] = [I]$$

Only square matrices have inverses. The command to calculate the inverse of a matrix is `minverse` in Microsoft Excel.

Calculate (in Excel) the inverse of the matrix $[B]$ above and verify that $[B]^{-1} \times [B] = [I]$.

**SIMULTANEOUS EQUATIONS**

Using Excel, put the following equations into matrix form and solve:

$$3x_1 + 6x_2 = 17$$
$$2x_1 + 5x_2 = 5$$