Consider the coupled elastic flap-lag equations on page 175 of the notes with zero forcing functions on the right-hand sides of the equation. Assume that:

\[ w = \beta_0 r + \beta_1 r^2 \]
\[ v = \zeta_0 r + \zeta_1 r^2 \]

1.) Put the above expressions into the elastic flap-lag equations, and work out the integrals and derivatives.

2.) Form two flap equations by multiplying the flap equation by \( r \) and integrating from 0 to 1 and then by \( r^2 \) and integrating from 0 to 1.

3.) Form two lag equations by multiplying the lag equation by \( r \) and integrating from 0 to 1 and then by \( r^2 \) and integrating from 0 to 1.

4.) Put the four equations into matrix form where all nonlinear terms are in the \([C]\) matrix:

\[
\begin{bmatrix}
\ddot{\beta}_0 \\
\dot{\beta}_1 \\
\dot{\zeta}_0 \\
\dot{\zeta}_1
\end{bmatrix}
+ \begin{bmatrix}
A & 0 & 0 & 0 \\
0 & A & 0 & 0 \\
0 & 0 & A & 0 \\
0 & 0 & 0 & A
\end{bmatrix}
\begin{bmatrix}
\dot{\beta}_0 \\
\dot{\beta}_1 \\
\dot{\zeta}_0 \\
\dot{\zeta}_1
\end{bmatrix}
+ \begin{bmatrix}
B & 0 & 0 & 0 \\
0 & B & 0 & 0 \\
0 & 0 & B & 0 \\
0 & 0 & 0 & B
\end{bmatrix}
\begin{bmatrix}
\beta_0 \\
\beta_1 \\
\zeta_0 \\
\zeta_1
\end{bmatrix}
= \begin{bmatrix}
0 \\
0 \\
0 \\
0
\end{bmatrix}
\]

5.) Check to make sure \([M]\) and \([K]\) are symmetric and \([C]\) is antisymmetric.