System: \[ t_j = \pi t + \frac{\pi}{2} (j-1) \]
Given Equations:

Central Mass:
\[ M \ddot{y} + K_y + \sum_{j=1}^{+} k_j x_j \omega^2 \theta_j = 0 \]  
Eq. (1)

Aerodynamic Paddles:
\[ k_j x_j = F_j = C \left[ (U + \dot{y}) \omega \theta_j - \dot{x}_j \right] \]

\[ C \dot{x}_j + k_j x_j - C \dot{y} \omega \theta_j = U \omega \theta_j \]
\[ j = 1, 2, 3, 4 \]  
(Equations 2, 3, 4, 5)

Derive these equations in multi-blade form by the following process:

a) Assume
\[ x_j = a_0 + a, \omega \theta_j + b, \sin \theta_j \]
\[ + c \theta_j (-1)^{j+1} \]
b.) Substitute $x_j$ into Eq. (1) and apply identities.

c.) Take
\[ \frac{1}{4} \sum_{j=1}^{4} (eq. j) \]
\[ \frac{1}{2} \sum_{j=1}^{4} (eq. j) \cos 4j \]
\[ \frac{1}{2} \sum_{j=1}^{4} (eq. j) \sin 4j \]
\[ \frac{1}{4} \sum_{j=1}^{4} (eq. j) (-1)^{j+1} \]

and apply identities.

Your final equations should be:

\[ M \ddot{y} + Ky + 2 \dot{k} a_1 = 0 \]
\[ c \ddot{a}_0 + k a_0 = 0 \]
\[ c \ddot{a}_1 + k a_1 + c \ddot{b}_1 - c \ddot{y} = \ddot{L} c \]
\[ c \ddot{b}_1 + k b_1 - c \ddot{a}_1 = 0 \]
\[ c \ddot{a} + k a \ddot{a} = 0 \]