Since $e^{j\omega t} \neq 0$, divide both equations by $e^{j\omega t}$.

$$- A\omega^2 m + bAj\omega + (k + k_c)A + k_c B = 0 \tag{1}$$

$$- B\omega^2 m + bBj\omega + (k + k_c)B + k_c A = 0$$

Putting these equations in matrix form,

$$\begin{bmatrix} k + k_c + bj\omega - m\omega^2 & k_c \\ k_c & k + k_c + bj\omega - m\omega^2 \end{bmatrix} \begin{bmatrix} A \\ B \end{bmatrix} = 0$$

$$\text{Now, } A = \frac{\begin{vmatrix} 0 & k_c \\ 0 & k + k_c + bj\omega - m\omega^2 \end{vmatrix}}{\begin{vmatrix} k + k_c + bj\omega - m\omega^2 & k_c \\ k_c & k + k_c + bj\omega - m\omega^2 \end{vmatrix}}$$

by Kramer's Rule.

Similarly for B,

$$B = \frac{\begin{vmatrix} k + k_c + bj\omega - m\omega^2 & 0 \\ k_c & 0 \end{vmatrix}}{\begin{vmatrix} k + k_c + bj\omega - m\omega^2 & k_c \\ k_c & k + k_c + bj\omega - m\omega^2 \end{vmatrix}}$$

In both cases the determinant in the denominator must equal zero for A or B to have a value other than zero.

Therefore,

$$\begin{vmatrix} k + k_c + bj\omega - m\omega^2 & k_c \\ k_c & k + k_c + bj\omega - m\omega^2 \end{vmatrix} = 0$$

This is the characteristic frequency equation for the system. In expanded form the characteristic equation becomes

$$(k + k_c + bj\omega - m\omega^2)^2 - k_c^2 = 0.$$

This is the difference of two squares and can be expanded as shown below: