

$$Ax = 0. \quad x = ?$$

$$\begin{bmatrix} -1 & 0 & 1 \\ 2 & 3 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{cases} -x_1 + x_3 = 0 \\ 2x_1 + 3x_2 + x_3 = 0 \end{cases}$$

$$\boxed{x_3 = \alpha.}$$

$$-x_1 + \alpha \Rightarrow \Rightarrow x_1 = \alpha.$$

$$2\alpha + 3x_2 + \alpha = 0 \Rightarrow \boxed{x_2 = -\alpha}$$

$$x = \begin{bmatrix} \alpha \\ -\alpha \\ \alpha \end{bmatrix}.$$

$$5^T x = [1 \ 3 \ 2] \begin{bmatrix} \alpha \\ -\alpha \\ \alpha \end{bmatrix} = \alpha - 3\alpha + 2\alpha = 0$$

$$A^T \lambda + b = 0$$

$$\begin{bmatrix} -1 & 2 \\ 0 & 3 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} \lambda_1 \\ \lambda_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 3 \\ 2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{cases} -\lambda_1 + 2\lambda_2 + 1 = 0 \\ 3\lambda_2 + 3 = 0 \end{cases}$$

$$\rightarrow \boxed{\lambda_2 = -1}$$

$$-\lambda_1 - 2 + 1 = 0$$

$$\boxed{\lambda_1 = -1}$$

$$\lambda_1 + \lambda_2 + 2 = 0$$

$$-1 - 1 + 2 = 0.$$

$$\lambda = \begin{bmatrix} -1 \\ -1 \end{bmatrix}$$

$$\boxed{A^T \lambda + b = 0}$$

$$M\ddot{q} - Q^A - Q^C = 0$$

$$M\ddot{q} - Q^A + \Phi_q^T \lambda = 0.$$

$$\cancel{M\ddot{q}} - \cancel{Q^A} - Q^C = \cancel{M\ddot{q}} - \cancel{Q^A} + \Phi_q^T \lambda$$

$$\boxed{Q^C = -\Phi_q^T \lambda.}$$