Problem 4

Part 1

$x_1^2 + x_2^2 + d x_1 x_3 + e x_2 x_3 + f x_3^2 = 0$ $\qquad$ $x_1^2 + x_2^2 = 0$

$x_3 = 0$

$I = (1 \;\; i \;\; 0)^T$

$I = (1,0,0)^T + i\,(0,1,0)^T$ $\qquad$ $J = (1 \;\; -i \;\; 0)^T$

$$C^*_\infty = \begin{bmatrix} 1 \\ i \\ 0 \end{bmatrix} \begin{pmatrix} 1 & -i & 0 \end{pmatrix} + \begin{bmatrix} 1 \\ -i \\ 0 \end{bmatrix} \begin{pmatrix} 1 & i & 0 \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Part 2

point trans formation

$X = H_s X$

$C^*_\infty{}' = H_s C^* H_s^T = C^*_\infty$

$I^T l_\infty = J^T l_\infty = 0$

$C^*_\infty I_\infty = (I J^T + J I^T) l_\infty = I (J^T l_\infty) + J (I^T l_\infty) = 0$

Part 3

$l^T C^*_\infty m = 0$

$(l_1 m_1, (l_1 m_2 + l_2 m_1)/2, l_2 m_2, (l_1 m_3 + l_3 m_1)/2, (l_2 m_3 + l_3 m_2)/2, l_3 m_3)\, c = 0$

$c = (a, b, c, d, e, f)^T$