

3/3.26

$$Ax = b$$

$$e = b - Ax$$

$$e^T = b^T - x^T A^T$$

$$J = e^T e = (b^T - x^T A^T)(b - Ax)$$

$$J = b^T b - b^T A x - x^T A^T b + x^T A^T A x$$

$$\therefore \frac{dJ}{dx} = 0 - A^T b - A^T b + 2A^T A x.$$

$$\therefore 2A^T b = 2A^T A x$$

$$\therefore A^T b = A^T A x$$

$$\therefore (A^T A)^{-1} A^T b = x$$

Add $\lambda^2 x^T x$ to the cost funcn.

$$J_2 = J + \lambda^2 x^T x$$

$$\therefore \frac{dJ_2}{dx} = -2A^T b + 2A^T A x + \lambda^2 2I x.$$

$$\therefore A^T b = (A^T A + \lambda^2 I) x$$

$$\therefore (A^T A + \lambda^2 I)^{-1} \cdot A^T b = x$$