⑤ **QP** 2023-9-21

$$x_1^2 + 4x_1x_2 + 9x_2^2 \qquad \frac{1}{2}x^T H x$$

$\times 2$ $\times 2$

$$H = \begin{bmatrix} 2 & 4 \\ 4 & 18 \end{bmatrix}$$

H symmetric

$\gamma = \beta$

$$(x_1 \;\; x_2)\begin{bmatrix} \alpha & \beta \\ \gamma & \delta \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\begin{bmatrix} \alpha x_1 + \beta x_2 \\ \gamma x_1 + \delta x_2 \end{bmatrix}$$

$$\frac{1}{2}\left(\alpha x_1^2 + \underbrace{\beta x_1x_2 + \gamma x_1x_2} + \delta x_2^2\right)$$

$$H = \begin{bmatrix} 3 & 8 \\ 8 & 6 \end{bmatrix} \rightarrow \frac{3}{2}x_1^2 + \frac{16}{2}x_1x_2 + \frac{6}{2}x_2^2$$

$$\frac{16}{2} = 8$$

$$\rightarrow \frac{3}{2}x_1^2 + 8x_1x_2 + 3x_2^2$$

(6)

$$f = \frac{1}{2} h x^2 + c x \qquad h, c \in \mathbb{R}$$

$$\nabla f = 0 \qquad h x + c = 0 \rightarrow x = -h^{-1} c$$

$$\frac{1}{2} x^T H x + c^T x \rightarrow x = -H^{-1} c$$

$A > 0$ leading principal minor > 0

$A < 0 \rightarrow (-A) > 0$ neg. definite

$A \lessgtr 0$? $\rightarrow$ $A > 0$? no $\longrightarrow$ indefinite
$-A > 0$? no

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$$y(n+1) + a\,y(n) = b\,u(n) + e(n)$$

a, b?

$$y(n+1) - \left[-y(n) \quad u(n)\right] \cdot \begin{bmatrix} a \\ b \end{bmatrix} = e(n)$$

$$\begin{bmatrix} y(2) \\ y(3) \\ \vdots \\ \vdots \\ y(N) \end{bmatrix} - \begin{bmatrix} -y(1) & u(1) \\ -y(2) & u(2) \\ & \\ & \\ -y(N-1) & u(N-1) \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} e(1) \\ e(2) \\ \\ \\ e(N-1) \end{bmatrix}$$

$$\downarrow$$

$$Y - \Phi \quad \alpha = E$$