Exam Solution

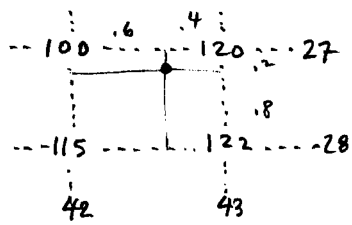
1. use relief displacement:

building A: $r = \sqrt{10^2+10^2} = 14.142$, $dr = \sqrt{4^2+4^2} = 5.657$

$$h_A = 200 = \frac{dr}{r}\cdot H = \frac{5.657}{14.142}\cdot H, \quad H = \frac{14.142}{5.657}\,200 = 499.982$$

building B: $r = \sqrt{6^2+6^2} = 8.485$, $dr = \sqrt{2^2+2^2} = 2.828$

$$h_B = \frac{dr}{r}\cdot H = \frac{2.828}{8.485}\cdot 499.982 = \underline{\underline{166.6}} \longleftarrow$$

2. 

$(l,s) = 27.2,\ 42.6$ Bilinear Interpolation

$=$ then $|$: $g_1 = .6\times 120 + .4\times 100 = 112$

$g_2 = .6\times 122 + .4\times 115 = 119.2$

$g = .8\times 112 + .2\times 119.2 = 113.44$, $\underline{\underline{113}} \longleftarrow$

$||$ then $-$: $g_1 = .2\times 115 + .8\times 100 = 103$

$g_2 = .2\times 122 + .8\times 120 = 120.4$

$g = .6\times 120.4 + .4\times 103 = 113.44$, $\underline{\underline{113}}$

3.

$$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}A & B\\-B & A\end{pmatrix}\begin{pmatrix}X\\Y\end{pmatrix} + \begin{pmatrix}C\\D\end{pmatrix}$$

$$\begin{pmatrix}u\\v\end{pmatrix} = \begin{pmatrix}a & b\\-b & a\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}c\\d\end{pmatrix}$$

$$\begin{pmatrix}u\\v\end{pmatrix} = \begin{pmatrix}a & b\\-b & a\end{pmatrix}\left[\begin{pmatrix}A & B\\-B & A\end{pmatrix}\begin{pmatrix}X\\Y\end{pmatrix} + \begin{pmatrix}C\\D\end{pmatrix}\right] + \begin{pmatrix}c\\d\end{pmatrix}$$

$$\begin{pmatrix}u\\v\end{pmatrix} = \begin{pmatrix}a & b\\-b & a\end{pmatrix}\begin{pmatrix}A & B\\-B & A\end{pmatrix}\begin{pmatrix}X\\Y\end{pmatrix} + \begin{pmatrix}a & b\\-b & a\end{pmatrix}\begin{pmatrix}C\\D\end{pmatrix} + \begin{pmatrix}c\\d\end{pmatrix}$$

$$\begin{pmatrix}u\\v\end{pmatrix} = \underbrace{\begin{bmatrix}aA - bB & aB + bA\\-bA - aB & -bB + aA\end{bmatrix}}\begin{pmatrix}X\\Y\end{pmatrix} + \underbrace{\begin{pmatrix}aC + bD + c\\-bC + aD + d\end{pmatrix}}$$

these are of the form: $\begin{bmatrix}E & F\\-F & E\end{bmatrix}\begin{pmatrix}X\\Y\end{pmatrix} + \begin{pmatrix}G\\H\end{pmatrix} \longleftarrow$

So they are related by 4-parameter transf. $\longleftarrow$

4. 1. $M_x(90^\circ) = \begin{bmatrix}1 & 0 & 0\\0 & \cos 90^\circ & \sin 90^\circ\\0 & -\sin 90^\circ & \cos 90^\circ\end{bmatrix} = \begin{bmatrix}1 & 0 & 0\\0 & 0 & 1\\0 & -1 & 0\end{bmatrix}$

2. $M_y(45^\circ) = \begin{bmatrix}\cos 45^\circ & 0 & -\sin 45^\circ\\0 & 1 & 0\\\sin 45^\circ & 0 & \cos 45^\circ\end{bmatrix} = \begin{bmatrix}.7071 & 0 & -.7071\\0 & 1 & 0\\.7071 & 0 & .7071\end{bmatrix}$

$$\underbrace{\begin{bmatrix}.7071 & 0 & -.7071\\0 & 1 & 0\\.7071 & 0 & .7071\end{bmatrix}}_{M_y(+45^\circ)}\underbrace{\begin{bmatrix}1 & 0 & 0\\0 & 0 & 1\\0 & -1 & 0\end{bmatrix}}_{M_x(+90^\circ)} = \begin{bmatrix}.7071 & .7071 & 0\\0 & 0 & 1\\.7071 & -.7071 & 0\end{bmatrix} \longleftarrow$$