$$= -\begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix} = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} = \gamma_2$$

$$-\gamma_1 \gamma_3 \gamma_1^{+} = -\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$
$$= -\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$
$$= -\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} = \gamma_3$$

$$-\gamma_2 \gamma_3 \gamma_2^{+} = -\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$$
$$= -\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} = -\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$
$$= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} = \gamma_3$$

These are the verifications for $j > i > 0$. Those for $i > j > 0$ are exactly similar.

$\therefore \sigma(u_i) = -u_i \qquad u_i = u \ (= u_1)$

$\sigma(u_i) = u_i \qquad u_i \neq u$

and $\sigma(u_i)$ is a reflection

$-\sigma(u_i) = u_i \qquad u_i = u = u_1 \ (-\sigma(u_i) = u u_i u)$

$= -u_i \qquad u_i \neq u$

is a rotation around the axis u_i ($-\sigma(u_i)$ is a composition of two reflections, hence is a rotation).

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