⑥

抽象的記号法を用いた定式化

$$[Z(t),\ Z^{\dagger}(t')]_{+}=\delta(t-t'),\quad [Z(t),\ Z(t')]_{+}=0$$

$$
\begin{aligned}
&Z^{\dagger}(t)Z(t)Z^{\dagger}(t')Z(t')\\
&=Z^{\dagger}(t)[\delta(t-t')-Z^{\dagger}(t')Z(t)]Z(t')\\
&=\delta(t-t')Z^{\dagger}(t)Z(t')-Z^{\dagger}(t')Z^{\dagger}(t)Z(t')Z(t)\\
&=\delta(t-t')Z^{\dagger}(t)Z(t')-Z^{\dagger}(t')[\delta(t'-t)-Z(t')Z^{\dagger}(t)]Z(t)\\
&=Z^{\dagger}(t')Z(t')Z^{\dagger}(t)Z(t)
\end{aligned}
$$

$$\therefore\ [Z^{\dagger}(t)Z(t),\ Z^{\dagger}(t')Z(t')]_{-}=0$$

$$
\begin{aligned}
&\int_{-\infty}^{\infty} dt\ Z^{\dagger}(t)Z(t+\varepsilon)\underline{Z^{\dagger}(a)|0>}\\
&=\int_{-\infty}^{\infty} dt\ Z^{\dagger}(t)[\delta(t+\varepsilon-a)-Z^{\dagger}(a)\overbrace{Z(t+\varepsilon)]|0>}^{0}\\
&=\underline{Z^{\dagger}(a-\varepsilon)|0>}
\end{aligned}
$$

$$
\begin{aligned}
\therefore\ &\int_{-\infty}^{\infty} dt\ Z^{\dagger}(t)Z(t+\varepsilon)\ Z^{\dagger}(a_1)\cdots Z^{\dagger}(a_n)|0>\\
&=\sum_{k=1}^{n} Z^{\dagger}(a_1)\cdots Z^{\dagger}(a_k-\varepsilon)\cdots Z^{\dagger}(a_n)|0>
\end{aligned}
\quad ※
$$