Second projection [nln35]

Rewrite memory function from [nln34] with projection operators from [nln33] and apply Dyson identity:

$$
\begin{aligned}
\langle f_0|f_0\rangle\Sigma_1(z) &= \left\langle f_1 \left| \frac{1}{z+\imath L_1} \right| f_1 \right\rangle = \left\langle f_1 \left| \frac{1}{z+\imath L_1 P_1 + \imath L_1 Q_1} \right| f_1 \right\rangle \\
&= \left\langle f_1 \left| \frac{1}{z+\imath L_1 Q_1} \right| f_1 \right\rangle - \left\langle f_1 \left| \frac{1}{z+\imath L_1 Q_1}\imath L_1 P_1 \frac{1}{z+\imath L_1} \right| f_1 \right\rangle \\
&= \frac{1}{z}\langle f_1|f_1\rangle - \left\langle f_1 \left| \frac{1}{z+\imath L_1 Q_1}\imath L_1 \right| f_1 \right\rangle \frac{\langle f_0|f_0\rangle}{\langle f_1|f_1\rangle}\Sigma_1(z),
\end{aligned}
$$

where simplifications analogous to [nln34] are carried out.

$$
\Rightarrow\ \Sigma_1(z) = \frac{\langle f_1|f_1\rangle/\langle f_0|f_0\rangle}{z + \dfrac{1}{\langle f_1|f_1\rangle}\left\langle f_1 \left| \dfrac{z}{z+\imath L_1 Q_1}\imath L_1 \right| f_1 \right\rangle},
$$

$$
\begin{aligned}
\left\langle f_1 \left| \frac{z}{z+\imath L_1 Q_1}\imath L_1 \right| f_1 \right\rangle = \cdots &= \left\langle f_1 \left| (-\imath) L_1 Q_1 \frac{1}{z+\imath Q_1 L_1 Q_1} Q_1 \imath L_1 \right| f_1 \right\rangle \\
&= \left\langle f_2 \left| \frac{1}{z+\imath L_2} \right| f_2 \right\rangle,
\end{aligned}
$$

with $|f_2\rangle = Q_1 \imath L_1 |f_1\rangle, \quad L_2 = Q_1 L_1 Q_1.$

Memory function (first termination function) after second projection expressed via second termination function:

$$
\Sigma_1(z) = \frac{\Delta_1}{z+\Sigma_2(z)}, \quad \Sigma_2(z) = \frac{1}{\langle f_1|f_1\rangle}\left\langle f_2 \left| \frac{1}{z+\imath L_2} \right| f_2 \right\rangle
$$

with continued-fraction coefficients $\Delta_1 = \langle f_1|f_1\rangle/\langle f_0|f_0\rangle$.

The n^{th} projection yields

$$
\Sigma_{n-1}(z) = \frac{\Delta_{n-1}}{z+\Sigma_n(z)}, \quad \Sigma_n(z) = \frac{1}{\langle f_{n-1}|f_{n-1}\rangle}\left\langle f_n \left| \frac{1}{z+\imath L_n} \right| f_n \right\rangle
$$

with $\Delta_{n-1} = \langle f_{n-1}|f_{n-1}\rangle/\langle f_{n-2}|f_{n-2}\rangle$
and $|f_n\rangle = Q_{n-1}\imath L_{n-1}|f_{n-1}\rangle, \quad L_n = Q_{n-1}L_{n-1}Q_{n-1}.$