Continued-fraction representation [nln36]

Relaxation function after n successive projections:

$$c_0(z) = \cfrac{1}{z + \cfrac{\Delta_1}{z + \cfrac{\Delta_2}{z + \cdots \cdots + \cfrac{\Delta_{n-1}}{z + \Sigma_n(z)}}}}$$

The explicit dynamical information extracted from the original many-body system, $\{L, |f_0\rangle\}$, in the first n projections is contained in the continued-fraction coefficients:

$$\Delta_1, \ldots, \Delta_n.$$

Each projection adds a layer of projection operators around the original Liouvillian:

$$L_n = Q_{n-1} \cdots Q_0 L Q_0 \cdots Q_{n-1}.$$

Expectation (somewhat naively):

- If n is sufficiently large, all distinctive spectral features of L will have been filtered out and incorporated explicitly into the relaxation function via the Δ_i.
- Whatever features of L still shine through the n filters are adequately represented by a source of white noise.
- The memory function associated with white noise is a constant, commonly represented by a relaxation time:

$$\Sigma_n(z) = \frac{1}{\tau_n} = \text{const.}$$

- This completion of the continued fraction is known under the name n-pole approximation. The relaxation function is characterized by n poles in the complex frequency plane.

Options used in practical applications:

- A number of continued-fraction coefficients are determined on phenomenological grounds along with a terminating relaxation time τ_n. Examples: classical relaxator (1 pole), classical oscillator (two poles).
- A number of continued-fraction coefficients are calculated from the original many-body system via the recursion method along with a termination function $\Sigma_n(z)$ inferred from an extrapolation scheme.