The dynamical fidelity susceptibility of decoherence free subspaces

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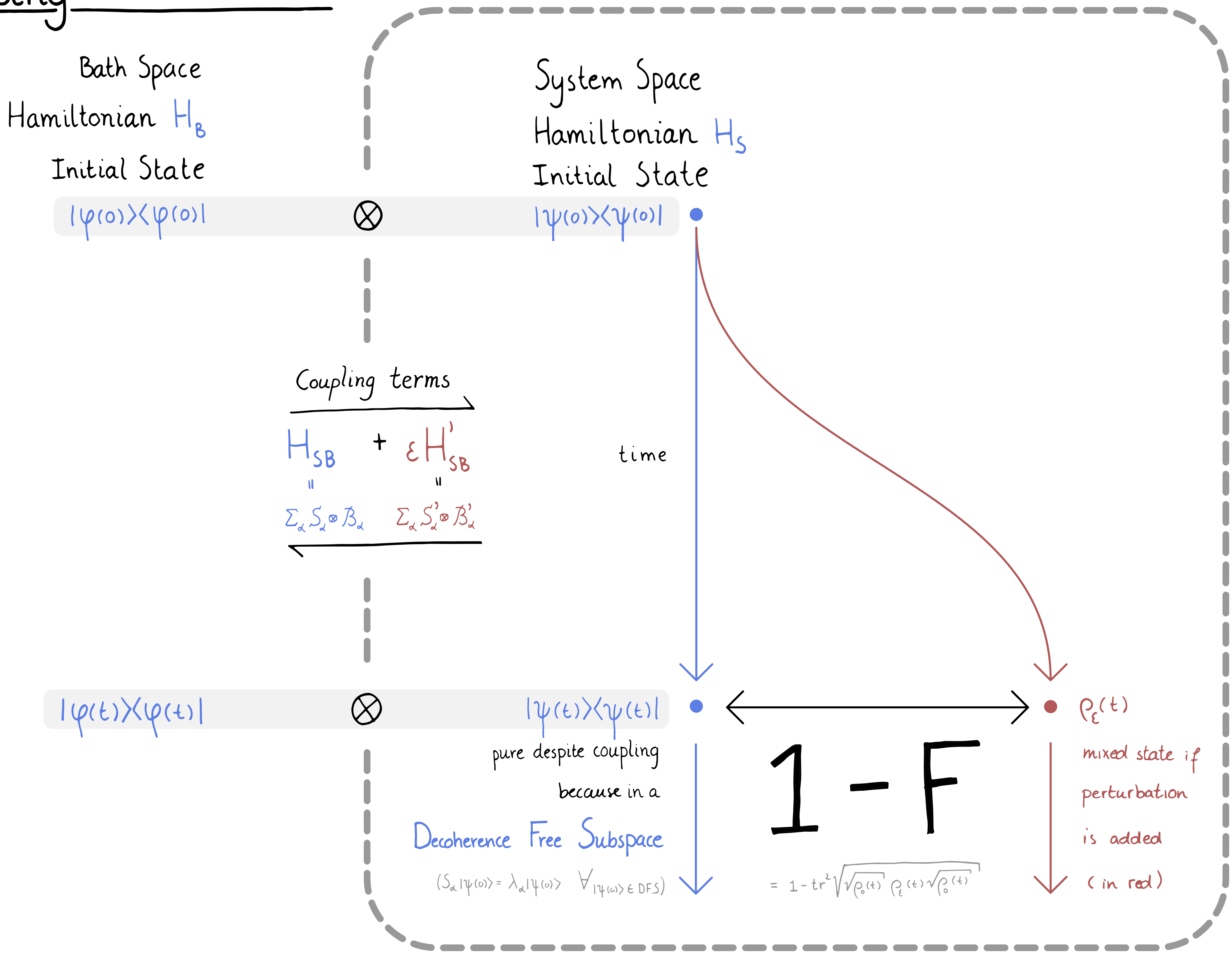
Setting



Question

How susceptible are DFSs to perturbations? Or: How does $1-F$ depend on ε, the system size n, and time t?

Answer

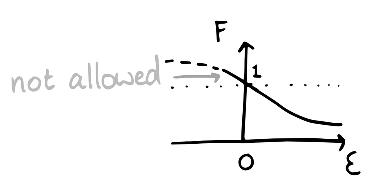
$$1-F = t^2 \varepsilon^2 \underset{\text{namesake of this poster}}{\chi} + O(\varepsilon^2 t^4)$$

where $\chi = \mathrm{tr}(B' S'^{T})$,

$$[S']_{\alpha\beta} = \langle\psi(0)|S'_\alpha S'_\beta|\psi(0)\rangle - \langle\psi(0)|S'_\alpha|\psi(0)\rangle\langle\psi(0)|S'_\beta|\psi(0)\rangle, \quad [B']_{\alpha\beta} = \langle\varphi(0)|B'_\alpha B'_\beta|\varphi(0)\rangle$$

Conclusions

- Never a term proportional to ε, so also when $H_S \neq 0$, or even $|\psi(0)\rangle\langle\psi(0)| \notin \mathrm{DFS}$.

  (This is because if $\varepsilon \neq 0$, 

  but $0 \le F \le 1$). This holds for finite baths, as well as in a *Lindblad*-setting. This is in contradiction with earlier work.
- $\chi = O(n^{2k})$ for H'_{SB} *k-local*. (I.e. H'_{SB} has at most k non-trivial tensor factors)
- No dependence on the unperturbed Hamiltonian, so our expression for χ holds outside of the context of DFSs whenever $H_{SB} = 0$.
- Further work: generalize to initial states outside a DFS. This will be the *Loschmidt* echo for open quantum systems.