Semi - Automatic Differentiation

$$\nabla J_T = \frac{\partial J_T(\{|\psi_n(T)\rangle\})}{\partial \varepsilon_{nl}}$$

$$|\psi_n\rangle \hat{=} z$$

$$\langle\psi_n| \hat{=} z^*$$

$$= 2\,\mathrm{Re} \sum_n \underbrace{\frac{\partial J_T}{\partial |\psi_n(T)\rangle}}_{\equiv \langle \chi_n|} \cdot \frac{\partial |\psi_n(T)\rangle}{\partial \varepsilon_{nl}}$$

$$; \quad |\chi_n\rangle = \frac{\partial J_T}{\partial \langle \psi_n(T)|}$$

$$= 2\,\mathrm{Re} \sum_n \frac{\partial}{\partial \varepsilon_{nl}} \langle \chi_n | \psi_n(T)\rangle$$