TikZ tensor network diagrams

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Finite MPS:

$$|\Psi\rangle = \underset{A_1}{\bigcirc} - \underset{A_2}{\bigcirc} - \underset{A_3}{\bigcirc} - \cdots - \underset{A_{N-1}}{\bigcirc} - \underset{A_N}{\bigcirc} . \tag{1}$$

Gauge transform:

$$\underset{A_i}{\bigcirc} \quad \rightarrow \quad \underset{G_{i-1}^{-1}}{\bigcirc} \underset{A_i}{\bigcirc} \underset{G_i}{\bigcirc} . \tag{2}$$

Left-orthogonal form:

$$\underset{A_i}{\bigcirc} \quad \rightarrow \quad \underset{L_i}{\square} , \qquad \underset{L_i}{\overset{L_i}{\square}} = \big[. \tag{3}$$

Right-orthogonal form:

$$\underset{A_i}{\bigcirc} \quad \rightarrow \quad \underset{R_i}{\square} , \qquad \underset{R_i}{\overset{R_i}{\square}} = \big] . \tag{4}$$

SVD:

$$\underset{A_i}{\bigcirc} \quad = \quad \underset{U}{\square} \underset{D}{\diamond} \underset{V^\dagger}{\square} . \tag{5}$$

Mixed-canonical form:

$$|\Psi\rangle = \underset{L_1}{\square} - \underset{L_2}{\square} - \cdots - \underset{L_{i-1}}{\square} - \underset{C_i}{\bigcirc} - \underset{R_{i+1}}{\square} - \cdots - \underset{R_{N-1}}{\square} - \underset{R_N}{\square} . \tag{6}$$

$$|\Psi\rangle = \underset{L_1}{\square} - \underset{L_2}{\square} - \cdots - \underset{L_{i-1}}{\square} - \underset{L_i}{\square} - \underset{D_i}{\bigcirc} - \underset{R_{i+1}}{\square} - \cdots - \underset{R_{N-1}}{\square} - \underset{R_N}{\square} . \tag{7}$$

Unitary gauge transformation:

$$\underset{L_i}{\square} \quad \rightarrow \quad \underset{U_{i-1}^\dagger}{\bigcirc} \underset{L_i}{\square} \underset{U_i}{\bigcirc} . \tag{8}$$

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Expectation value:

$$\langle\Psi|O_i|\Psi\rangle = \qquad A_{i-1}\ \ A_i\ \ A_{i+1} \qquad\qquad . \tag{9}$$

$$\langle\Psi|O_i|\Psi\rangle = \qquad L_{i-1}\ \ C_i\ \ R_{i+1} \qquad\qquad = \qquad C_i \qquad . \tag{10}$$

Multi-site expectation value:

$$\langle\Psi|O|\Psi\rangle = \qquad L_{i-1}\ \ C_i\ \ R_{i+1} \qquad . \tag{11}$$

MPO:

$$\qquad = \qquad . \tag{12}$$

MPO expectation value:

$$\langle\Psi|H|\Psi\rangle = \qquad L_{i-1}\ \ C_i\ \ R_{i+1} \qquad = E_{i-1}\ \ C_i\ \ F_{i+1} = E_i\ \ D_i\ \ F_{i+1}\,. \tag{13}$$

Environment tensors:

$$E_1 \equiv \quad L_1 \quad, \qquad E_i \equiv E_{i-1}\ \ L_i \quad . \tag{14}$$

$$F_N \equiv \quad R_N \quad, \qquad F_i \equiv \quad R_i \quad F_{i+1}\,. \tag{15}$$

iMPS:

$$|\Psi\rangle = \cdots \qquad \cdots . \tag{16}$$

Transfer matrix:

$$T = \qquad . \tag{17}$$

MPS norm:

$$\langle\Psi|\Psi\rangle = \qquad . \tag{18}$$

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Left-orthogonal form:

$$\tag{19}$$

Right-orthogonal form:

$$\tag{20}$$

Mixed-canonical form:

$$|\Psi\rangle = \cdots \tag{21}$$

$$= \cdots . \tag{22}$$

iMPS expectation value:

$$\langle\Psi|O_i|\Psi\rangle = \cdots \qquad = \rho_L . \tag{23}$$

$$\langle\Psi|O_i|\Psi\rangle = \cdots \qquad = . \tag{24}$$

Environment tensor recursion relation:

$$E(n+1)\bigg|{-}\alpha = E(n)\bigg|{-}\alpha + \sum_{\beta<\alpha} E(n)\bigg|{-}\beta{-}\alpha . \tag{25}$$

Big diagram:

$$
\begin{array}{cccccc}
A_1 & A_2 & A_3 & & A_{N-1} & A_N
\end{array}
$$

$$|\Psi\rangle = \qquad \cdots \qquad . \tag{26}$$

Inline diagram: $|\Psi\rangle = $ ⊶⊶⊶ $\cdots$ ⊶⊶ .

Patterns for tensors:

$$
\begin{array}{cc}
N_L & X
\end{array}
$$

$$B^s = . \tag{27}$$

iPEPS:

$$|\Psi\rangle = \cdots \qquad \cdots . \tag{28}$$

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Schmidt decomposition:

$$\underset{\substack{| \ | \ | \ \ldots \ | \\ 1 \ 2 \ 3 \quad N}}{\boxed{}} = \underset{\substack{| \ \ldots \ | \\ 1 \quad n}}{\boxed{}} - \bigcirc - \underset{\substack{| \ \ldots \ | \\ n+1 \quad N}}{\boxed{}} . \tag{29}$$