Entangled Basis Finite Element Method PDE solver for Quantum Computer

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(Dated: October 13, 2023)

1. FINITE ELEMENT METHOD (FEM)

2. TENSOR NETWORK (TN)

3. TARGET EQUATION

In this work, we are considering a class of partial differential equation (PDE) that is linear in time (LT-PDE) as shown in Eq. of a tensor-valued function, $\mathbf{u}(t, \mathbf{q})$, of time, $t \in \mathbb{R}$, and D-dimensional space, $\mathbf{q} \in \mathbb{R}^D$, where we use boldface variables to indicate tensors.

$$\mathbf{h}(t, \mathbf{q}, \mathbf{u},) + \sum_{r_t=1}^{R_t} \mathbf{g}_{r_t}(t, \mathbf{q}) \cdot \partial_t^{r_t} \mathbf{u} = 0 \tag{3.1}$$

4. FEM REPRESENTATION OF LTA-PDE

5. TENSOR OPTIMIZATION

6. MATRIX PRODUCT STATE (MPS) REPRESENTATION

7. IMPLEMENTATION